BACK TO BASICS: ELECTRONICS

1989

47380

Radio Control CAR ACTION

THE WORLD'S PREMIER R/C CAR MAGAZINE — CANADA $3.75 — USA $2.95

BEHEMOTH: SIX-WHEELED SLAYER

Kyosho's NEW MAXXUM

CALIFORNIA SLIDE

JR X2 OVAL CONVERSION

Budget PANDA STOCKER

FUTABA PCM the new radio technology?

Understanding BEC Circuitry

08

ON THE COVER: Bottom: JG's JR-X2 dirt-oval conversion power-sliding its way through the turn. Photo by Wally David. Upper left: Bad Brain O'Brien's creation, the Behemoth. Photo by Bill O'Brien. Upper right: Futaba's new Magnum PCM 1024. Photo by Steve Pond. Top right: A.J.'s Challenger pulling sled being towed by a Tamiya Clod Buster. Photo by Steve Pond.

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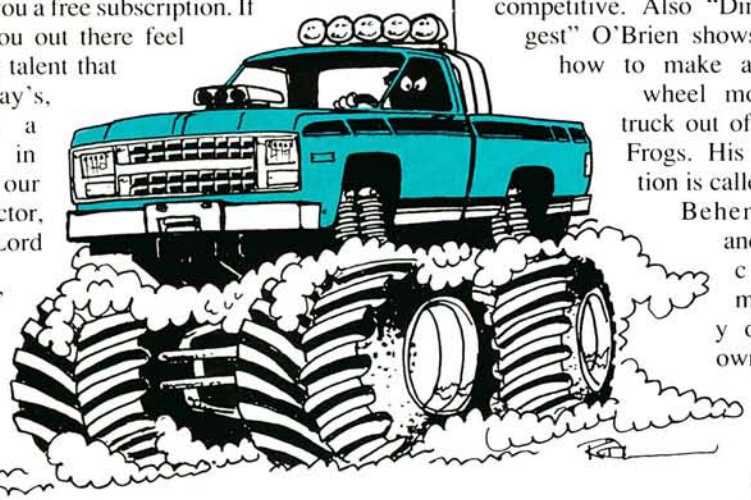
EDITORIAL

by CHRIS CHIANELLI

THIS LINE DRAWING of the Clod Buster was done by Ray G. Daley. His letter said, "My local hobby shop ordered a Clod Buster for me, and the last few days of waiting have been pure hell! I've read everything I can on this truck, so I started making drawings of it." Ray, all of us at *Car Action* liked the drawing so much that we're sending you a free subscription. If any of you out there feel you have talent that rivals Ray's, send us a sample in care of our Art Director, Alan "Lord of the Board" Palermo. I'm sure that many of you have noticed our Reader's Survey in the July issue of *Car Action*. I'm also sure that many of you have noticed the Content Review Section, or, should I say, incomplete Content Review Section. The value scale that rates the editorial material (i.e., very valuable, somewhat valuable, not valuable) is missing from the top of the check-box columns. Please see our Letters section in this issue for a correction entitled "Survey Omission," so that you can label the columns and we'll be able to tabulate your votes. According to Mad Mac (Ed Schenk, our Computer Systems Manager), there was a ghost in the machine. Personally, I think someone slipped some disappearing ink into the machine.



This month, Wally David brings us a dirt-oval conversion for the JR-X2, which many report to be *very* competitive. Also "Dirt Digest" O'Brien shows you how to make a six-wheel monster truck out of dead Frogs. His creation is called the Behemoth, and you can make your own easily with Bill's chassis template. Thank you, Mr. Bill.

Next month, *Car Action* will feature the Kyosho Hi-Rider Vette, a shootout between three after-market RC10 transmissions and (weather permitting) an RC10/JR-X2 shootout. Obviously, we show no mercy toward the feeble "competition." Unlike them, I know you can't wait for the next issue. While we're working on it, I suggest you soak your delicate trigger fingers in a foot-massage machine. ■

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LETTERS

WHERE TO WRITE TO US

If you're writing to the editors (and we'd love to hear from you), please be sure to address your letters to "Letters," *Radio Control Car Action*, 251 Danbury Road, Wilton, CT 06897.

Survey Omission

Hold on, all you Eagle Eyes! We caught the mistake on our Readers' Survey before you did. King Yura says, "No free decals are leaving the office for this mistake."

In case you didn't catch it, on page 147 of the July issue of *Car Action* (last month to you!), we ran a Reader Survey for you to fill out and send in. In the section marked "RCCA Content Review," we listed all the features and departments that regularly appear. After each title were three boxes. We forgot to tell you what each column of boxes meant. Here's how it was supposed to look:

RCCA CONTENT REVIEW

Please rate the following features and departments.

Features	Very Valuable	Somewhat Valuable	Not Valuable
24) Project cars	❑	❑	❑
25) Budget Racer series	❑	❑	❑

If you haven't gotten around to sending in the survey, please mark the columns and check off the boxes accordingly. Remember, all of you who send in your survey before August 31, 1989, will be eligible to win a new Futaba Magnum.

RH

Eagle Eye of the Month

Just thought I'd write to mention a mistake I found in the article entitled "Highway Hornet" (May '89, page 104).

Positive camber occurs when the tire-wheel combo leans out at the top. When the tire-wheel combo leans in at the top, it's called negative camber!

It's a minor error that I'd normally overlook, but I'd really like to win a sub to this excellent mag!

JEFF CHAMBERS
Fayetteville, GA

You won, Jeff! However, my eagle eye has found a mistake in your letter, possibly intended to fool me. I'd love to send you a subscription, but unfortunately the Eagle Eye award is Car Action decals. Maybe if you'd gotten my last name correct...well, no sense pondering what might have been.

THAT CRAZY GUY, CC

Beef of the Month

Why is it when an electronic speed controller is advertised, all that's stressed for the most part is its continuous and/or peak/surge amp rating? Whatever happened to the other side of the equation? *Volts?* Not everyone runs a 6- or 7-cell pack, and I'm sure it's not for a lack of a supplied technical information sheet from the manufacturer stating the min/max number of cells to be used. So, how about the complete picture? For example, state the min/max number of cells and/or voltage rating of the unit. This would make life easier for us neo-techs (unite!) who would like to calculate things like: voltage multiplied by amps (current) = power (watts), voltage divided by amps = resistance, etc. And yes, I've heard of the telephone, but you haven't seen my phone bill at the end of the month!

John T. Mosely, I agree with you—there's a lot more clarity/info required in advertisements, and thanks for the chart, *Car Action!!*

GREG CARLISLE
Mission Viejo, CA

Greg, we at Car Action share your feelings that there's a lack of accurate information supplied with some speed controllers. Another problem is the lack of standards for rating speed controllers. To cite one example, a look in the International Rectifier handbook for power FETs reveals that a cold FET has a lower ON resistance than a hot FET. A specification based on this cold-temperature rating results in a V/A rating that's unobtainable

(Continued on page 10)

LETTERS

RUSSELL HAMILTON
Bellevue, WA

Very chic, Russell; a fresh supply of Car Action decals is coming your way.

CC

Shootout Cometh

Face it, your magazine is the best! As a proud owner of a new JR-X2, I'm requesting a shootout between the RC10 and the JR-X2.

I also own an Associated 12L. It seems to me that there is more attention going to the 1/10-scale cars. I'd appreciate more coverage on the 1/12-scale scene.

Also, the super stock racing class is an excellent idea!

JEREMY P. SHREVES
Petaluma, CA

Rick Houle is working on the RC10/JR-X2 shootout as we speak. I hope that it will be ready for the next issue. I'll let Rich Hemstreet respond to the rest of your letter: CC

Jeremy, while 1/12 scale is still alive, the real activity and growth is taking place in the 1/10-scale arena, particularly at superspeedways like the one at Lake Whippoorwill. As a media source, we must reflect the activity that's going on across the country. We'll continue to cover 1/12-scale races and review 1/12-scale cars as they become available to us.

RH

Access For All

I want to thank you for putting out a great magazine each month.

(Continued on page 12)

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under hot operating conditions.

The other fact that has emerged from our "Scoping Out" testing of speed controllers is that the voltage-drop rating is almost always for the FETs only and doesn't include wire, fuses, printed circuit board, or connectors. Anyway, the minimum number of cells that most speed controllers will operate with is four. The reason for this is that four cells yield 5V, which is the practical lower limit to operate the BEC circuit and the internal electronics of the controller itself. The maximum number of cells should be determined by the voltage rating of the FETs, typically 50V (30 cells to allow some safety margins), but the limit is usually 10 cells or 12.5V. The reason for this is that there is a voltage developed inside an FET speed controller called the bias voltage. This is the voltage used to turn on the FETs. When the cell count gets too high, this bias voltage can no longer control the FETs. A partially turned-on FET generates enormous amounts of heat and destroys itself. In a 6-forward FET/1-brake FET setup, the first FET to be damaged is the lone brake FET. Also, I surmise that there are other voltage limits involved, e.g., the safe upper limit of the input voltage to the BEC voltage regulator chip. In a future "Scoping Out," we'll try to contact the manufacturer for missing information, such as min/max cell ratings, and publish these numbers in the "Manufacturer's Specs" section of the article.

As a neo-tech, you won't want to miss my article, "Volt! Ohm! Amp! Watt?" in this issue.

JR

Rabid Racer of the Month

Hi ya! It's the space needle. I'm glad (nay, delighted!) you've continued to expand *Car Action*. I love the mag! I have *Car Action* stickers on my Fox and Super Sabre (which I bought, in part, because of *Car Action's* article). Tamiya rules.

LETTERS

(Continued from page 10)

Being in a wheelchair, I was glad to see Mike Lee point out that drivers' stands should be accessible. I've been racing for about four years now at various small club tracks, and I find it difficult to see the course clearly while racing. I hope that clubs will keep this in mind when building their own stand, so that racing will be fair for everyone.

Keep up the good work!

DAN WILLIAMS
Tempe, AZ

Something we all need to be reminded of—thanks, Dan.

CC

RC10 Torpedo Correction

In the July issue of *Car Action*, we omitted a few items from the parts chart for the RC10 Torpedo article. The chart is intended to provide readers and hobby shops with the numbers necessary for ordering the parts. The list should have included the following:

ASSOCIATED

TQ rims (front)	6852
TQ rims (rear)	6802
TQ tires (front)	6870S, M, H (soft, med, hard)
TQ tires (rear)	6820S, M, H (soft, med, hard)

PARMA

RC10 Gear Cover	12500

SP

Hybrid Out of Necessity

Three weeks before our local track's season-opener, my RC10 was stolen from my house. I couldn't afford a new RC10, so I bought an AYK Buffalo that was on sale. The car had a few problems, and I knew right away it wouldn't be competitive. While on my way to the local hobby dealer via an old trail I always use to get to town, I found my RC10 in a million pieces. It would have cost more to fix it than to buy a new one, so I salvaged the transmission and rear shocks and attached them to the Buffalo, along with new steering blocks and front axles. I took it out for a test run and the improvement was 1,000 percent. It even out-handles the RC10 cars in the corners. I want to thank *Car Action* and our local dealer at Prichards RC Corner; without you guys I'd be racing in the dark.

DAVID RENALDO
Catharague, NY

Talk about making the best of a situation—my hat is off to you, David. A pox on the creep who stole your car and then destroyed it—what a loser; he'll get his. Send me some photos of your Buffalo/RC10 hybrid showing the chassis suspension combo, and, if the photos are decent, I'll put it in the letters section. Later, my friend.

CC

Color-Coordinated Controller

You have a great magazine. You're so helpful to everyone, and I hope you can help me. I've looked and looked, but I'm unable to find a Tekin ESC in either of my favorite colors. Can you help me find one in either British Racing Green or a nice light blue to match my eyes?

PAUL M. BRUNING
Monticello, NY

Gee, Paul, sorry, can't help you out; but if you find a purple one to match my purple hair, let me know.

CC

We Don't Stand Corrected

In your March '89 article entitled "On-Road RC 10," Wally David wrote that ROAR maximum wheel tread is 9 7/8 inches and that Andy's Arms and BBS tires should be used. That's no problem up front, but 2 inches of rubber mounted on the rear? No way, not without turning the tire around. Other than that; nice article.

I'd also like to point out that there's an error in Dick Brinton's Lazer Track Report (page 94). He said the front tires use a 5x11 bearing and that the 5x10 are

(Continued on page 14)

LETTERS

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standard. He also said that he couldn't find the 5x11 and feels that the importers should tell you where to find them. I don't know what cars Dick does drive, but it sounds very much like he's only into Kyosho.

Since I work in a hobby shop, I don't want people to read these articles and come to me and say that your magazine said this or that, if it isn't true. (The article on the bearings almost lost me a sale.)

STEVE LICHTENBERG
Omaha, NE

Steve, Wally David merely mentioned the existence of the 2-inch BBS wheels and made no mention of how to put them on the car. In his follow-up article, entitled "Homemade Chassis" (April '89), he explained in detail how to put the 2-inch wheels on, and he did reverse the rims. Some might feel that it's better not to mention a part if you don't explain how to put it on, but others are glad to get the information.

If your comment that Dick Brinton only drives Kyosho is true, then how would you explain the fact that Dick has done a three-part series in the Budget Racer on the Tamiya Falcon, addressed the Tamiya Grasshopper II and kicked off the series with Budget Blackfoot?

I'm sorry you nearly lost a sale on the bearings; however, we're here for the reader. Dick was explaining a problem with obtaining a set of bearings, obviously in his local area. It would only follow that we at Car Action would want our readers to check in their local area before purchasing the car. There's no question that the readers appreciate this kind of info prior to making a purchase. CC

Ask the Ayatollah

I own an Optima Mid with an EX-7 sport. Since there's reverse on the electronic speed control (the CX-IIR), is there any race (modified) that I can enter, or did I just waste my money on this purchase?

Also, does the Ayatollah of radio control see a Project Double Dare in the near future?

BRANDON HILL
Aurora, Ontario

You didn't waste your money, because the EX-7 is a solid little radio. Yes, if your club uses ROAR rules, you can't use reverse. Furthermore, the CX-IIR was never designed to be used with hot modified winds, but it works fine with stock motors. Your EX-7 will work well with other speed controllers that can handle modified motors and seven cells.

The Ayatollah has decreed: "There shall be a Project Double Dare, so let it be written, so let it be done!" Watch for it in the Monster Truck Special, which will be available in August. CC

Cobra Control

I read your January issue, and I think it's great so far. In the boat article about Hobby Lobby's Cobra, you didn't mention if it came with the drive unit. Do I have to supply the motor if it comes with the drive unit?

I own a Grasshopper that's now converted to a Hornet. Since I don't have an electronic speed controller, could I use the Hornet speed controller in the Cobra, or am I going to have to run to my hobby shop and buy an electronic speed controller? I'm interested in this boat, so you gotta tell me.

ERIC TENNANT
Thunder Bay, Ontario

Eric, the Cobra hull and drive unit had been available separately. However, like the Hobby Lobby Electric-Vee and Monster-Vee, the Cobra is now available as a package, including hull, surface-drive unit and BoLINK speed controller for under $130. You don't need an electronic speed controller for electric boats; mechanical controllers will work fine. CC

We welcome your comments and suggestions. Letters should be addressed to "Letters," *Radio Control Car Action*, 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, due to the tremendous number of letters we receive, we cannot respond to every one.

READERS' RIDES

Welcome to "Readers' Rides"! We continually receive photos of readers' latest projects, so we've decided to start featuring some of the more innovative stuff to give all our readers a glimpse of these neat cars and trucks, etc. So here we go! If you want to be part of this new feature, send us a nice color photo of your project with a brief description, and we'll show it to the Ayatollah of Radio Controlla at the next editorial meeting to see if he'll publish it!

If we publish your photo, we'll give you a one-year subscription to RCCA, or extend your existing one, and you'll even be eligible for our "Readers' Rides Car of the Year Contest" in the fall of '89. Send your photos to Readers' Rides, R/C Car Action Magazine, 251 Danbury Road, Wilton, CT 06897.

Craig Irvine of Detroit, MI, sent us this picture of an Associated 12L that he built and races to relieve stress?! Craig's 12L is a fiberglass version that features a Trinity Monster Horsepower stock motor, a Futaba Magnum Jr. radio system and MC-112B ESC, Trinity 64-pitch gears and an Associated Jaguar Group C body.

Warren Bader's Rolling Thunder MK Engineering Funny Car looks like it's going 100 sitting still (it just might go that fast)! The 1/6-scale dragster features an OPS .60 nitro engine, a Futaba radio system and some killer 50-percent nitro fuel. Warren managed to place 6th on his racing circuit and took 2nd spot at the 1/4-scale Nationals last year at ATCO Raceway. Maybe *you'll* take top honors at this year's event!

Here's a picture of a beautifully camouflaged RC10 from Calvin Chan of San Francisco, CA. It has been intricately hand-crafted, and although his handiwork isn't visible with the body on, the chassis has been cut out for lightness. He did all the work with *hand tools*, and you'd never know this by looking at it. Terrific work!

It took a little prodding from his friends before Jeff Taylor finally broke down and dusted off his camera so that he could send pictures of his rides to *Car Action*. His Blackfoot features a Thorp differential, Associated shocks, HD steering and a Race Prep modified motor. In tow is his CAM-powered Fine Design Firefox Funny Car that runs two 7-cell packs (I'm sure it's as fast as it looks).

This Big Boy Toys RC10 sprint-car conversion built by Harry Kellermann of Virden, IL, is one of the sharpest we've seen (and the wing is in one piece)! Harry's sprint car has all the goodies, including a Track Master gearbox, TQ wheels, a Futaba 2PD Magnum radio, a Novak 1X speed controller and Imex Road Dawg tires. Thanks for dustin' off the old camera.

From the land of NASCAR comes this sharp-looking TRC Pro 10 built by Billy Fisher of Fayetteville, NC. Billy's Pro 10 has a Traxxas electronic speed controller, a Speedworks Oval motor, a Futaba radio system, Tecnacraft wheels and BoLINK tires.

Although we generally wouldn't choose a photo of a vehicle standing in grass (unless it's an R/C lawnmower!), we let this one by. This highly detailed Clod Buster was built by 23-year-old Rusty Howard of Springfield, IL. Without going into the many fine details of the truck, we'll just say that Rusty chromed the stock chassis, then borrowed a number of parts from plastic model kits to add the details. Next, he slapped on some sparklin' Sees aluminum wheels and he's got a "Readers' Rides" winner!

The "Orange Crunch," which hails from Hilton Head, SC, is owned and operated by Larry Matics. Larry tells us this creation is the result of fusing a Tamiya Leopard tank, a Lexan Lunch Box body and some serious handcrafting. How'd you like to be on the receiving end of *this* one?

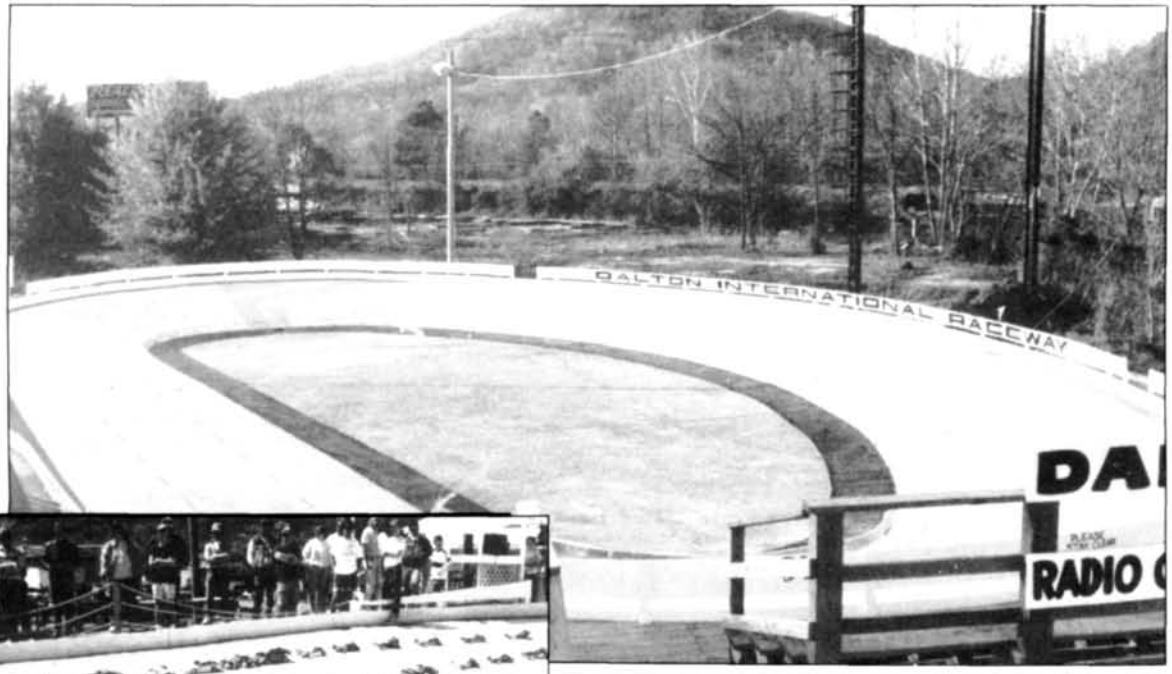
This sharp-lookin' Monster Beetle is the handiwork of 15-year-old Greg Stogren of Grimsby, Ontario, Canada. Greg tells us that his Beetle has Big Bear tires with Pro-Line chrome rims, full ball bearings, a Reedy stock motor and a Futaba Magnum Sport radio. Greg is saving his dough for an electronic speed controller and a Speedworks 350 motor. He also said he'd greatly appreciate us putting his Beetle in *Car Action*. Well, here you go!

HOT TRACKS

Dalton International Raceway
Dalton, Georgia

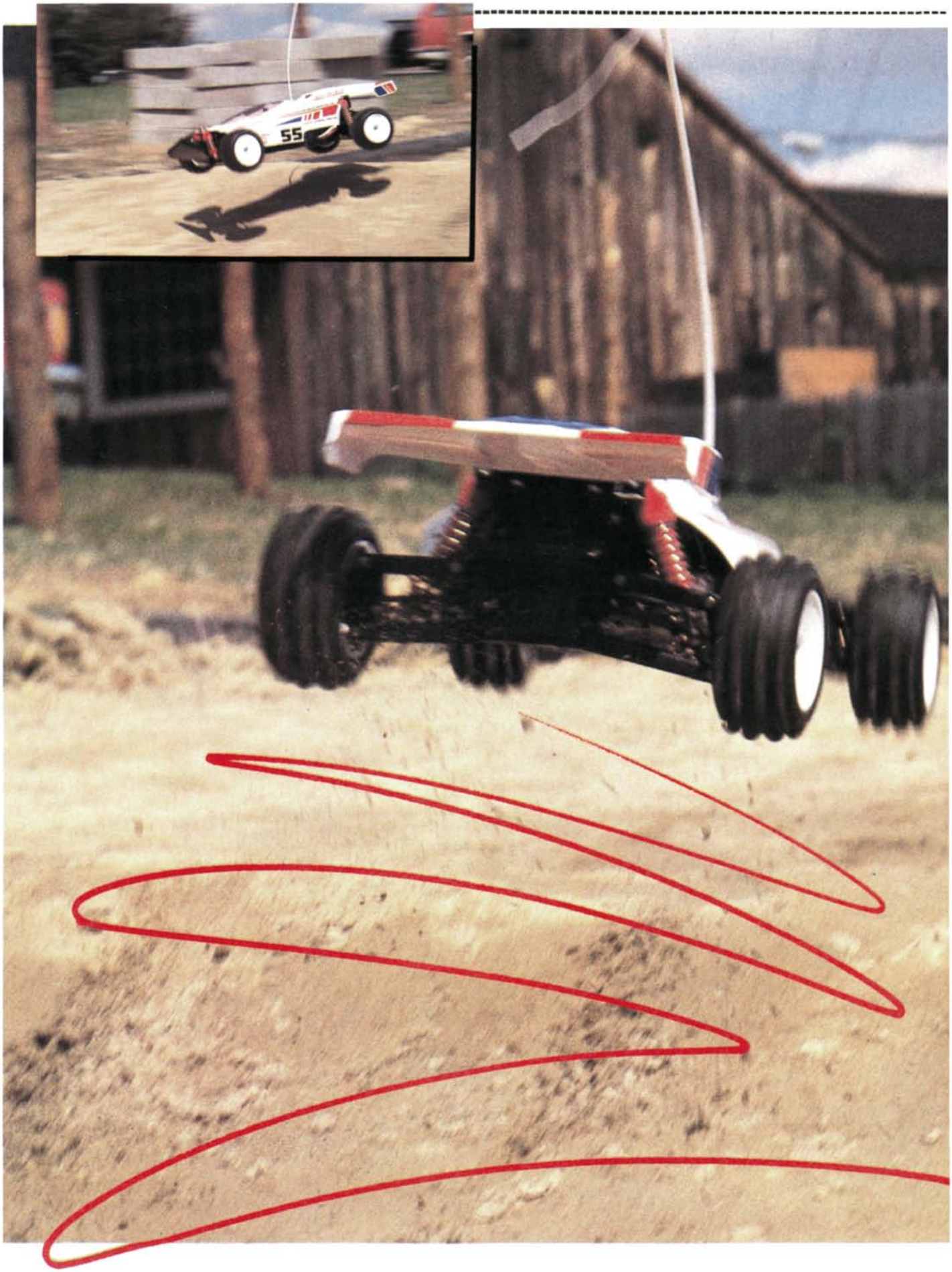
by DANNY SANE

Welcome to "Hot Tracks." Each month, we'll choose an outstanding track to feature in this column. To qualify, send in some high-quality, black-and-white photos of your track, along with a description (500 words or less), outlining why your track should be chosen. Send your entries to Hot Tracks, Radio Control Car Action, 251 Danbury Road, Wilton, CT 06897.



AFTER THREE YEARS of off-road racing, Dalton Raceway Hobbies has built an all-new facility called Dalton International Raceway. Completed in March 1989, the track is a 305-foot tri-oval with 37-degree banking. Unlike other concrete superspeedway tracks, DIR offers races in several different classes. Stomper Class is one of the most exciting, with the big trucks racing wheel to wheel. At DIR, cars that cost less than $150 (Tamiya-type cars) run in the Stock Class, while the Superstock Class includes cars like RC10s and JR-X2s. The 1/12-scale class is really growing, but Direct Drive 1/10-scale is the main event—both Stock and Modified race in this one—and there are usually lots of spectators.

With a spacious new hobby shop and friendly personnel, the local racers have a fun place to race. And after all, that's what it's all about! Check out Dalton International Raceway at 2300 Chatt Rd., Dalton, GA 30720. ■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KYOSHO AERO STREAK

by FRED MURPHY

Four-Wheel-Drive Fast Entry

DOUBLE-WISHBONE INDEPENDENT suspension, oil-filled shocks, front and rear differentials and a stock 05 motor. What does that sound like to you? To me, it sounds like a pretty hot 4WD setup. As a matter of fact, this buggy even gives you the time-proven shaft drive to the front gearbox, and it's fully factory assembled. Just add the radio of your choice and a charged-up battery pack, and head for the starting line.

Kyosho* has drawn on its winning experience to provide the R/C world with the Aero-Streak—a well-designed, reliable, entry-level, ready-to-run, 4WD, off-road buggy that's ideal for the newcomer to our sport. A novice can take this car to the local track and be competitive in the production class with a true out-of-the-box car. At the same time, the flexible Aero-Streak's performance can be increased as the driver's experience increases.

THE KIT: Using a different body style, the Aero-Streak is the ready-to-run version of the Kyosho Shadow. Instead of the traditional, three-window, coupe body used by many off-roaders, the Aero-Streak has a more futuristic look that's very sleek and aerodynamic. The body is constructed of molded white ABS plastic, which can be very easily painted your favorite color or left as is for the application of the included decals. The body is pre-trimmed to fit, and the body-mounting holes and antenna hole are pre-drilled. It couldn't be easier!

The main chassis is a bathtub-type design. In other words, it's a fully enclosed unit that protects the electrics and radio system most effectively. The double-wishbone suspension has oil-filled coil-over shocks on each corner. It can be adjusted by using a series of coil-spring spacers that are included with the car, and it allows you to adjust the front toe-in to maximize your car's steering response under a variety of track conditions. The drive train comprises front and rear planetary gear dif-

(Continued on page 23)

Photos by Steve Pond

KYOSHO

AERO-STREAK

Type ..... 4WD assembled off-road
Scale 1/10
Sug. Retail Price $224.95

DIMENSIONS:
Overall Length ..... 16.50 inches
Width ..... 9.25 inches
Height ..... 5.25 inches
Wheelbase ..... 10.15 inches
Front Track ..... 8 inches
Rear Track ..... 8 inches

WEIGHT:
Gross (w/bat.) ..... 56 ounces

BODY:
Type ..... Buggy
Material ..... White ABS

CHASSIS:
Type ..... Tub
Material ..... ABS plastic

DRIVE TRAIN:
Type (pri./sec.) ..... Pinion-spur/shaft
Differentials ..... Planetary gear
Bearings/bushings ..... Plastic bushings

SUSPENSION:
Type (f/r) ..... A-arm
Dampening (f/r) ..... Coil-over oil-filled shocks

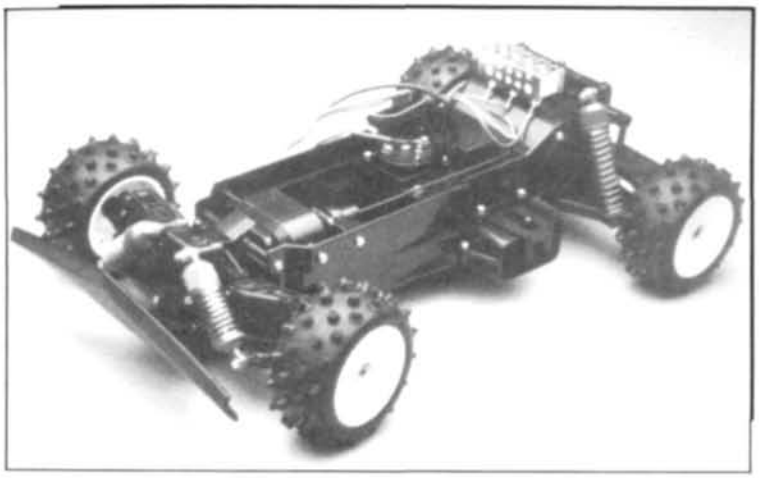
WHEELS:
Type (f/r) ..... One-piece
Dimensions (DxW) (f/r) ..... 2.1x1.25 inches

TIRES:
Front/Rear ..... Spike

ELECTRICS:
Motor ..... LeMans stock 05 motor
Battery Req'd. ..... 6-cell stick
Speed Controller ..... 3-step rotary

OPTIONS AS TESTED:
Futaba Magnum Jr.

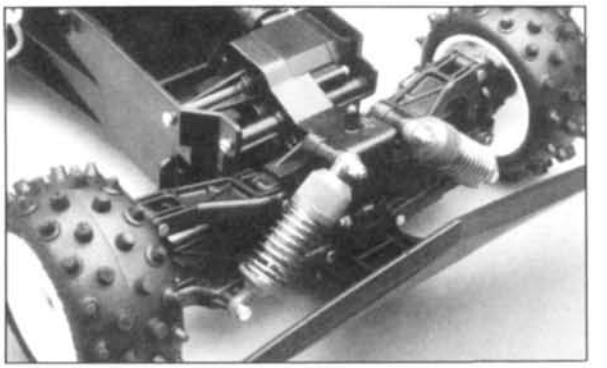
COMMENTS:
The perfect 4WD off-roader for newcomers. No assembly required other than installing the radio system and placing the decals on the body. It's designed with the future of the owner in mind: Many existing Kyosho hop-up parts for the more expensive cars will fit. As the owner's experience and skill increases, the Aero-Streak's performance will improve as well.



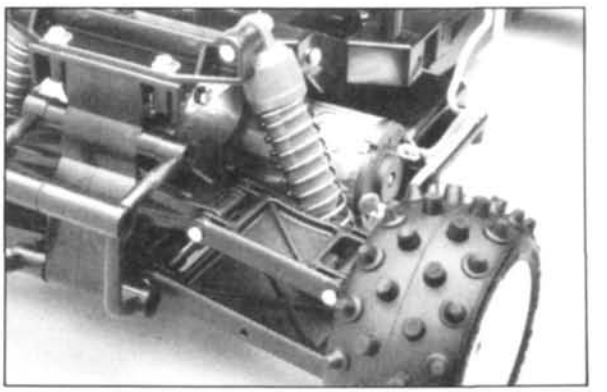
Shown just as it comes out of the box, the Aero-Streak features a strong tub-type chassis, low-maintenance shaft drive and the new heavy-duty three-step speed controller.

ferentials that are similar in design to the differentials found in the reliable, efficient, higher-performance Kyosho cars. Power transfer between the front and rear gearboxes is via a drive shaft, which will eliminate the need for drive-train adjustments that the more sophisticated chain- and belt-drive systems demand.

The Aero-Streak's speed control is Kyosho's heavy-duty rotary control, which provides you with three forward speeds, a neutral position and one speed in reverse. This control features spring-loaded contact points to help keep wires from binding, and it's fully shielded to keep dirt out and maintenance to a minimum.



The front half of the 4-wheel independent suspension features heavy-duty upper and lower A-arms that are dampened by coil-over oil-filled shocks.



Tucked in ahead of the rear suspension arms is the mid-mounted LeMans Stock 05 motor.

The LeMans stock 05 motor will provide a newcomer with all the power he or she needs at entry level. With great forethought, Kyosho has taken into account that R/C enthusiasts quickly become more skillful and has made the Streak adaptable. The motor mount is fully adjustable, so if the standard 16-tooth gear doesn't fit the bill, an Aero-Streak owner can use one of four optional pinions ranging from 13 tooth to 17 tooth—an option many other ready-to-runs don't offer.

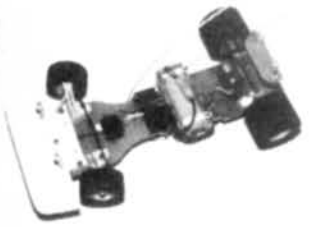
The flexibility of gear ratios means the Aero-Streak will also handle the more powerful motors when the driver's skill increases. Other options that will fit this buggy with no modifications are: ball-bearing-upgrade kits to really maximize performance; larger-diameter wheels and low-profile tires (used by many of today's high-technology cars);

(Continued on page 100)

INSIDE SCOOP

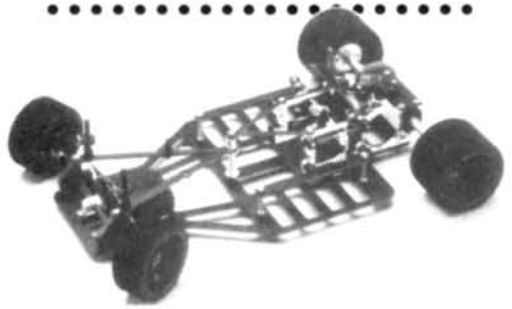
by CHRIS CHIANELLI

The R/C CAR industry is rapidly advancing, with new products being offered at a head-spinning rate. So, I'll make manufacturers nervous, but feed you R/C squirrels who are hungry for info, by bringing you a special report on security leaks and "late-in" items. Here goes!



MORE 1/8-SCALE ELECTRIC

Up until now, it's been a well-kept secret that Custom R/C Cars of Derry, NH, has been making an electric conversion for the Associated RC 250 called the CK-100. Owing to its extremely smooth and predictable handling, it seems that this 1/8-scale car—along with the C&M car I wrote about in April—has been very well received by small circles in the Northeast and on the West Coast. Its forgiving nature, a most welcome characteristic for novices, doesn't come at the expense of performance: These cars are very fast on superspeedway oval courses. Custom R/C Cars can also supply a complete rolling chassis (minus body, electrics and radio) called the CK-250.



SIZZLING SUPERSPEEDWAY CAR

Canada's Super A Distributing is now importing a 1/10-scale on-road racer called the Sizzler, and it's manufactured by PB Racing Products. Some of its features are: aluminum computer-milled rear side plates, two-layer black composite chassis and a rear axle that's suspended by a five-link De Dion chassis design with panhard-rod rear suspension. The car reportedly has a ready-to-race weight of approximately 40 ounces. I don't know of any distributor in the U.S., but for more info, you can write to Super A Distributing at 12 Rockford Rd., Willowdale, Ontario, Canada M2R 3A2.

MONSTER HAMMER

Reliable sources have informed me that Traxxas, of Dallas, TX, is working on a 2WD monster truck called the Sledge Hammer. This 1/10-scale truck features a T-6 aluminum chassis, fully independent suspension and eight oil-filled shocks. Availability? Some time in late fall.

MAJOR DANGER 4WD

A major manufacturer is planning to release an all-new 1/10-scale 4WD off-roader aimed directly at the World Championships. All I can say is that the car is manufactured by a name that's already BIG on the international circuit. Look for its first appearance at the ROAR Off-Road Nats in late July.

READY RAIDER

While Rich "THE WALL" Hemstreet was dominating the aisles at the last Toledo show, he came across the information that an almost-ready-to-run Raider (as yet un-named) will soon be available. Rich was also able to extract the info that it will come in some *very* bright colors. No one can withhold information from "THE WALL"!

FULLY INDEPENDENT SUSPENSION 1/10-SCALE ON-ROAD CAR

Rumor has it that TRC is developing a 1/10-scale, on-road racer with a fully independent suspension. If TRC can keep the weight and cost down, this could be a real breakthrough. The old ABC 1/12-scale floppy car was one of the best-handling cars ever; it just wasn't very durable. Keep an eye out for secret testing in North Carolina, and let us know if you see anything suspicious!

CRACKED CRYSTAL BALL

In my June Editorial, I misrepresented Dan's RC Stuff's involvement in the Global Hobbies' Panda IROC race. I'll let Dan Moynihan of Dan's RC Stuff set the record straight in his own words:

"While I personally think the Global Panda "IROC' is a wonderful idea, Dan's RC Stuff was not a sponsor of that event. We did promote and sponsor our Sportsmanship award at that particular race, and I even got to run one of the Pandas. I took 4th and loved it!

"I think what happened is that you (Chris Chianelli) looked into your crystal ball and saw the upcoming *Car Action*/Thunderdrome/Whippoorwill Races and watched the top five invitational drivers and the top five amateur racers slug it out in yet another Panda IROC race.

"McAllister Racing, along with Dan's RC Stuff, will host the Thunderdrome event, and the Panda IROCs will be there! That's where you must have gotten the idea into your head, Chris."

Ah...yeah, yeah, that's the ticket, ah...right on, that's what happened to me. Anyway, thanks for setting the record straight, Dan, and thanks for your interest in such events. The hobby is that much better off as a result.

CC

PEAK PANDA

Global Hobbies, the people who brought us the Panda Monte Carlo Stocker, will be introducing a 1/10-scale version of Danny Thompson's PEAK-sponsored Chevy S-10 Mickey Thompson Stadium Racer. This truck is based on the same chassis as the Panda stocker and off-roader. Available very soon.

BARON LeBOLINK

A 1/10-scale Chrysler LeBaron body has been introduced to the industry by BoLINK. Mopar is returning to superspeedway racing on the full-scale ARCA circuit. The full-scale car was featured on the cover of "Stock Car Racing" magazine's June issue.

Keeping the industry BUGGED, I'll see you next time– or sooner, if I catch you in my spyglass! CC

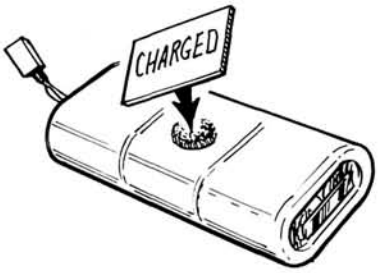
PIT TIPS

by JIM NEWMAN

PARTS CLEANER BASKET

Save that old instant coffee scoop; then drill lots of holes in it. Small parts can be placed inside while washing them so that they don't get flushed down the sink. If you can find a polyethylene scoop, so much the better, since, unlike the usual polystyrene scoops, it doesn't dissolve when used with chemical solvents.

Edward J. Mana, Jr., Brooklyn, NY



CHARGED-PACK REMINDER

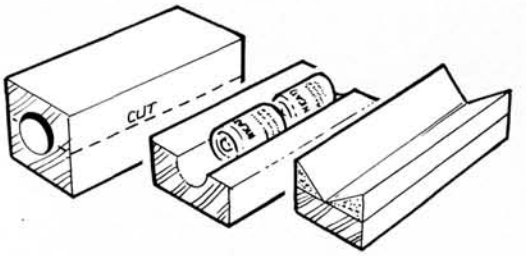
When you possess several packs, it can be confusing to recall which one is charged during the heat of the battle. Mark "charged" on some thick cards or plastic labels, then glue those little Velcro circles to the backs and to the packs. As each pack is charged, slap one of your labels on it.

Rick Hitchcock, Claremont, NH

MILK-JUG PARTS BIN

If you cut an empty milk jug as shown, it will hold all sorts of useful parts—a great place to store spare tires, for instance. A laundry marker will write well on the plastic, and if you label the jugs just below the handle, it makes them really convenient to lift on or off the shelf, with the i.d. readily visible.

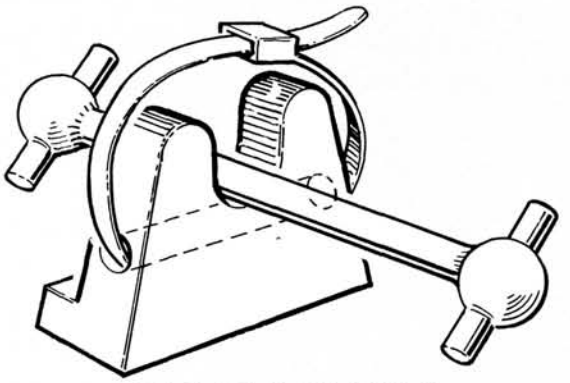
Scott Johnson, Spokane, WA



BATTERY SOLDERING JIG

Drill a hole down through a block of wood, the hole being the same diameter as your Ni-Cd cells. Now saw the block lengthways, and you have a useful cradle to hold the Ni-Cds while you assemble them into packs. Or, use balsa-wood triangular stock glued to a block. It works just as well!

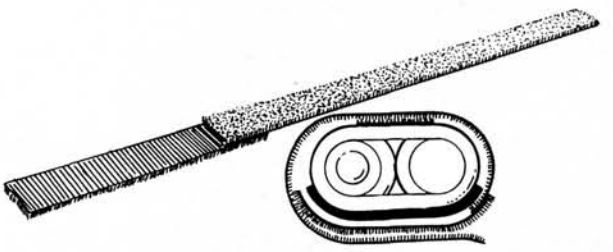
Clement Lee, Scarborough, Ontario, Canada



DOGBONE RETAINER

If you own a Mini Mustang, this modification works well—all for the cost of a couple of Radio Shack cable ties. Drill through the drive-shaft retainer; then pass the cable tie through the hole, pull it tight and snip off the excess. Now you won't lose that dogbone should it become disconnected.

Ngun Joon Chiew, Selangor, W. Malaysia



QUICK-RELEASE BATTERY STRAP

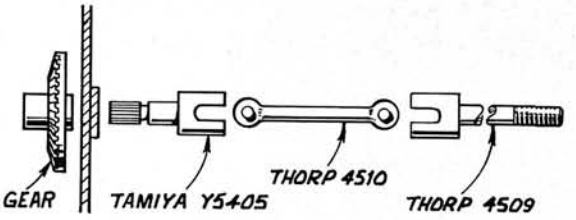
Calling all Kyosho owners! Here's a replacement for that hard-to-release battery strap: two strips of Velcro sewed together as shown and a short length glued to the top of the pack to stop it from sliding side to side. Wrap the strap around the pack and the holder, pull tight and stick down.

George Spatz, Champaign, IL

Radio Control Car Action will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Pit Tips." Send rough sketch to Jim Newman, c/o **Radio Control Car Action,** 251 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we cannot acknowledge each one, nor can we return unused material.

PIT TIPS

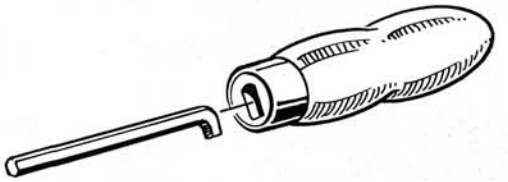
by JIM NEWMAN



BLACKFOOT PLUS THORP

The tougher Thorp axles can be used on the Blackfoot if you use the Tamiya Boomerang/Hot Shot/Super Shot original gears. The gear and gear case shown represent all Frog-type gear cases—just order the parts numbered.

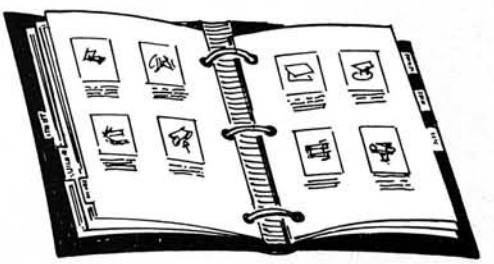
David J. Day, Stevensville, MD



ALLEN WRENCH MODIFICATION

Obtain some inexpensive file handles from the hardware store; then cut your Allen wrenches as shown, leaving just a short 90-degree bend. Securely epoxy the bent end into the handle and carefully check the alignment. You will now have wrenches that are easy to use and less likely to be lost.

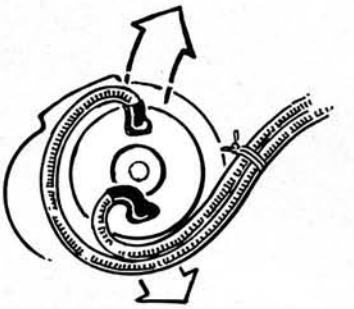
Nick Darpino, Glenolden, PA



READY REFERENCE PIT TIPS

This reader clips all his pit tips, then sorts them into categories (Tools, Batteries, Finishing, etc.). Next, he pastes the various category groups onto plain sheets, which he snaps into a three-ring binder between appropriately tabbed and color-coded dividers, creating an instant reference work.

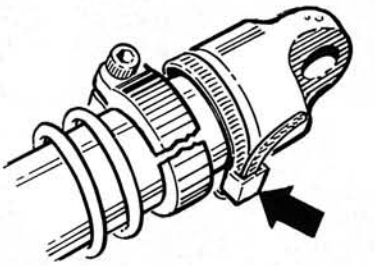
Pete Springer, Portland, OR



BROKEN HORNET WIRING

Constant pivoting up and down of the motor and gearbox in this owner's car causes fatigue fractures of the motor wires. His answer was to lengthen the wires so that they could be wrapped in a spring-like curve before soldering them to the motor tabs. This allows the wires to flex much more easily—especially if you use the highly flexible wire from your dealer. You can strengthen the soldered connection by slipping a heat-shrink sleeve over the wire and the tab.

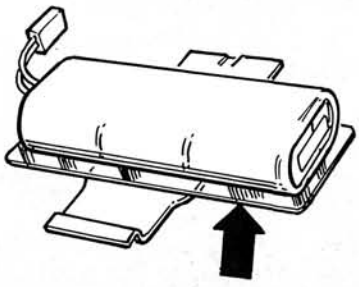
Tom Helner, Dearborn, MI



BROKEN SHOCK COLLAR

Shock collars do occasionally break, and this allows the spring to slide up the shock body and alter the spring pre-load. A successful temporary fix is to pull a nylon cable tie tightly around the shock to keep the collar in the correct position.

Richard Leske, Buffalo Lake, MN



BATTERY-PACK ARMOR

Exposed battery packs take a beating from rocks, and dented Ni-Cd cases usually lead to internal short circuits. Sketch shows a piece of Lexan placed under the pack before the battery retainer is snapped in place.

Cory Hendrixson, Renton, WA

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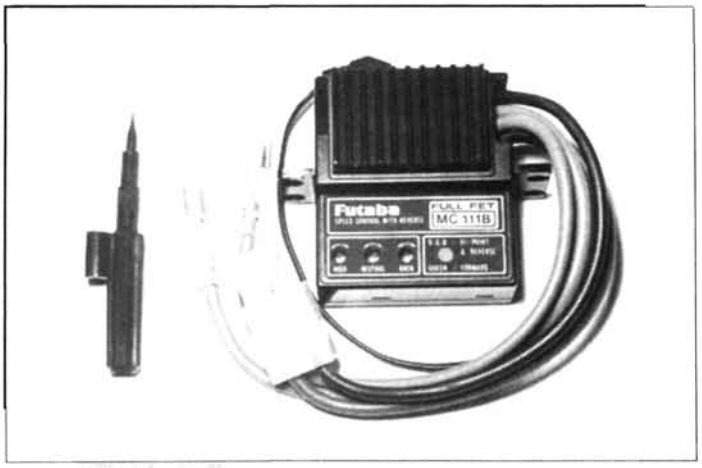
SCOPING OUT

by JOHN RIST

THE FUTABA MC111B: BIG ON GUTS; SMALL ON PRICE

HAPPINESS IS AN FET speed controller. This month, I ran the Futaba MC111B electronic speed controller through its paces. This speed controller comes with forward, reverse and brakes, and it's equipped with the Futaba* J-style connector. The MC111B has the same "footprint" as the standard Futaba servo, so it should fit very nicely in any car that uses a standard servo driving a mechanical speed controller. The fun part of installing an FET speed controller is that you can throw out the old mechanical speed controller and, if your car doesn't have BEC, the voltage-dropping resistor and the separate receiver battery pack, as well. This gives you a spare servo to replace the old steering servo that you beat to a pulp when jumping all those wonderful ramps and bumps that just happened to get in your way.



The MC111B has the following features:

- BEC (battery-elimination circuit)
- forward, reverse and brakes
- adjustable delay on reverse
- LED for adjusting neutral and full speed
- three trim pots for setting neutral, high-point and brake/reverse response
- 130-amp continuous-current capability
- 500-amp peak-current capability
- built-in heat-sink
- servo-style mounting lugs
- 6- or 7-cell battery capacity (7.2V to 8.4V)
- supplied adjustment screwdriver

The MC111B isn't all that small, but, as I said, it will fit in the space that was occupied by the old servo, and it's a reversing controller, which tends to be bigger. It should fit just about any 1/10-scale car or truck. Reading the instruction sheet and inspecting the speed controller provided a lot of information, but my lab tests revealed just how capable it was.

My lab setup consists of an oscilloscope, a digital voltmeter, a resistor load bank and a 6-volt, 30-amp lab supply. The oscilloscope is used to monitor the controller's output to guarantee that it's fully on, and the digital voltmeter takes all the voltage-drop readings and verifies the current meter's reading. The resistor load bank is a bank of 40 12-ohm, 5-watt power resistors, which can be switched on and off one at a time to vary the load from .6 amps to 20 amps. In series with the resistors is a 25-amp Simpson current meter and a 1-per-

(Continued on page 100)

TEST DATA
Model MC111B

DIMENSIONS:

Height	1.0 inches
Width	1.6 inches
Length	1.8 inches
Weight	2.4 ounces
Access to Controls	Good
Ease of Adjustment	Fair
Warranty	120 days

ELECTRICAL:
(Manufacturer's Specs)

Max Voltage	8.4 volts
Min Voltage	7.2 volts
Max Current Forward	500 amps
Continuous Current Forward	130 amps
Resistance	0.008 ohms x 2 (.016 ohms total)

TEST PARAMETERS:

Voltage	6 volts
Current	12 amps
Voltage Drop	.33 volts
Resistance	0.0275 ohms
Retail Price	$109.95

COMMENTS:

A well-built electronic speed controller designed to take up the same amount of room as a regular-size servo. It even has servo-style mounting lugs. One major drawback is the lack of an on/off switch. While not blowout-proof, the MC111B did take the abuse on the test bed without smoking.

BEHE

by BILL O'BRIEN

IT'S NOT THAT I didn't like my Blackfoot, but after two years of owning it—and two Frogs—I had wrenched every ounce of performance possible from that particular chassis. My 'Foot was dependable to the point of being predictable, and I was just bored. So I converted one of the Frogs into a racing truck and disassembled the remaining Frog and the Blackfoot for parts. But, like some amiable R/C Transformer, it wasn't long before the parts began to assemble themselves into what has become the Behemoth.

Basic Design

The Behemoth is partially scratch-built, partially put together with Hot Trick* parts and thoroughly monstrous to look at. From its massive rear bumper to its front ram, it's 25 inches long; and to the tip of its roll-bar-mounted fog lights, it's 13 inches

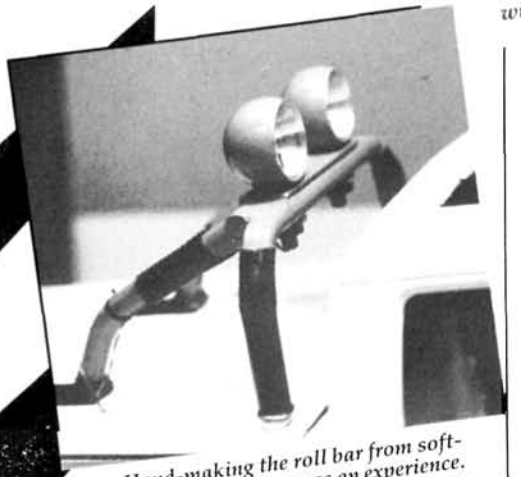
DOUBLE BARREL

MOTH

BLACKFOOT!

BEHEMOTH

The front grill is just a small brass box mounted on a flat plate. Brass tubes were added across the face of the box and the entire assembly was edged with a strip of brass.



Hand-making the roll bar from soft-wall brass tubing was an experience. The sides of the tube bent wherever pressure was applied, until I sealed one end and filled the tube with sand.

high. Aluminum, brass and acrylic make up its skeleton. Capped by its stretched and brass-rimmed Blackfoot body and with its 6-volt 2500mAh Yuasa battery sitting in its cradle, it buckles the scale at 10.78 pounds. And while I envy Steve Topjian's incredible scale work on his Kraco 18-wheeler (*R/C Car Action,* April '89), I'm much too impatient to spend more than the eight hours it took me to shape and assemble the parts that gave Behemoth its somewhat distinctive appearance.

Twin Blackfoot differential cases are slung between Hot Trick diff supports and handle Behemoth's rear 4WD system. The once-humble Frog gears were scrapped, and the case was stuffed with Thorp* Hot Shot ball differentials and spur gears (stock Blackfoot pinions). Real dogbones (an option with the Hot Shot diffs) connect the twin gearboxes to the four rear-wheel hubs. Complete with steering arms, the front end has been lifted from a Hot Trick kit.

At the end of each of the six axles is a humongous Imex truck-pull tire. Designed for the Lunchbox, these tires are larger and wider than the Tamiya* stock rubber, although they do fit standard Blackfoot rims. (Bru-Line* Super System 4406 wheels are a better option, but they provide less clearance for the motors. If you plan to use stock 540s or LeMans 360STs, or any other full-can-style motor, you'll run into problems.)

Keeping all this mass out of the grass are two pairs of Kyosho* short Red rear shocks (a sacrilege, considering the Behemoth's origin as two Tamiya kits). Front crunch-and-bounce chores have been assigned to Kyosho long Gold shocks.

CONSTRUCTION: All things must begin somewhere, and the Behemoth began as two Hot Trick chassis blanks that came with Frog and Blackfoot hop-up kits. The truth is that I was never really impressed with the Hot Trick kits. Half the screws I needed for the installation didn't seem to be in the kit, and even the standard Tamiya Frog or Blackfoot shocks couldn't be used. Rather than go through what I thought would be two tedious installations, I decided to do one monstrous conversion.

The chassis was the main problem: The Hot Trick chassis plate is more than strong enough for a standard-wheelbase truck, but I had my doubts about its doing the kind of double duty I had in mind—espe-

SPECIFICATIONS

Scratch-built chassis with Hot Trick mounting accessories.

Length: 25 inches

Height: 13 inches

Wheelbase: 11.5 inches front to middle diff; 17.5 inches front to rear diff

Track: (f/m/r): 9.5/9/9 inches

Rear Suspension: Trailing arms with short Kyosho Red shocks.

Front Suspension: Rigid bars with long Kyosho Gold shocks.

Tire Diameter: 5.5 inches

Motors: Twin LeMans 480Gs

Differentials: Thorp Hot Shot ball diffs with dogbone conversion.

Weight: 10.78 pounds
Two-channel radio required for basic operation.

If bigger is better, then tires are no different than anything else. Originally Bru-Line Super System wheels were used with the Imex tires, but the wheel mounted too far inboard to work with all possible motor lengths.

The Parma hood scoop was mounted from underneath the hood, and fast-drying auto-body spot putty was used to fill in the gaps.

cially when two normal-size small chassis were being bolted together to make one longer chassis. I had done a lot of work with plastics some years ago, so I picked up a 3/8-inch-thick sheet of 15x4-inch acrylic.

Were it not for the fact that the Frog and the Blackfoot use trailing arms, the acrylic sheet could have stayed as it was. But because of the trailing arms, the chassis had to be narrowed in the six places indicated on the illustration. (The front was narrowed mostly for aesthetics, although a small amount was done to prevent the front wheels from banging into the chassis on sharp turns.) Other than that, it's just a small matter of dropping in the Hot Trick frames and supports with the appropriate Frog/Blackfoot parts.

One other thing was apparent right from the beginning: Despite the 3/8-inch-thick acrylic base, there was still more chassis flex than desirable. As a quick cure, I ran a pair of 1/4-inch-square brass stock from the front uprights back to the middle differential. From that center diff, I ran a single brass girder to the rear differential. Not only did that stiffen things up, but it also gave me somewhere to build a cradle for the battery and a saddle for the speed controller.

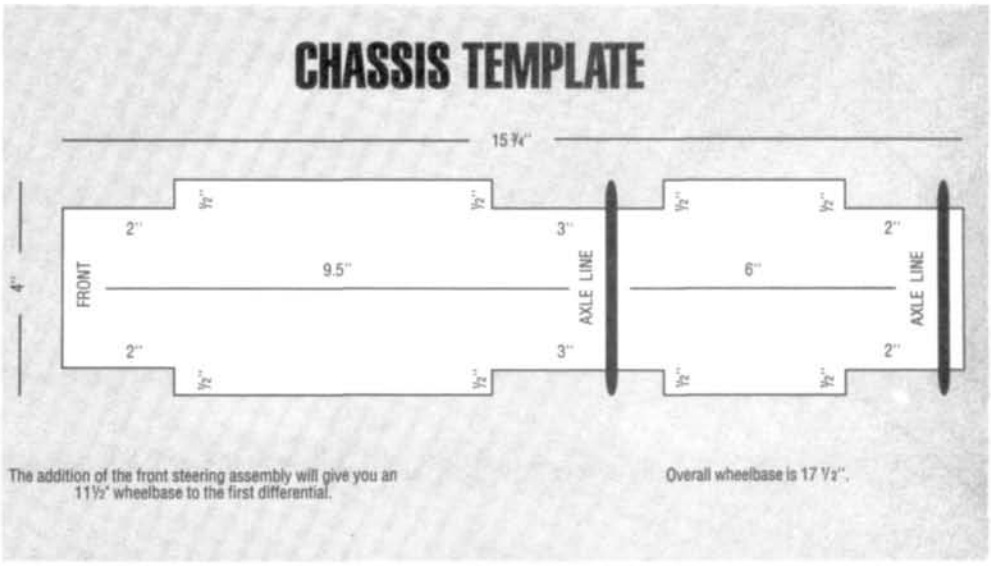
The body is the stock Blackfoot Ford Ranger that came with the truck. It has been chopped across the bed and extended nearly 6 inches through the judicious use of balsa wood and brass. Thin brass edging was also used to bind the segments around the wheel wells and to maintain the stiffness of the frame at the perimeter of the bed.

There's no adequate way to describe the amount of work that went into the body. Parts of it (the sides, especially, as the bed deck was just a flat piece of wood that was trimmed to size and laid in place) were sculpted to resemble the lines of the original truck. That's one of the benefits of working in balsa wood; it's very easy to shape with some light sandpaper.

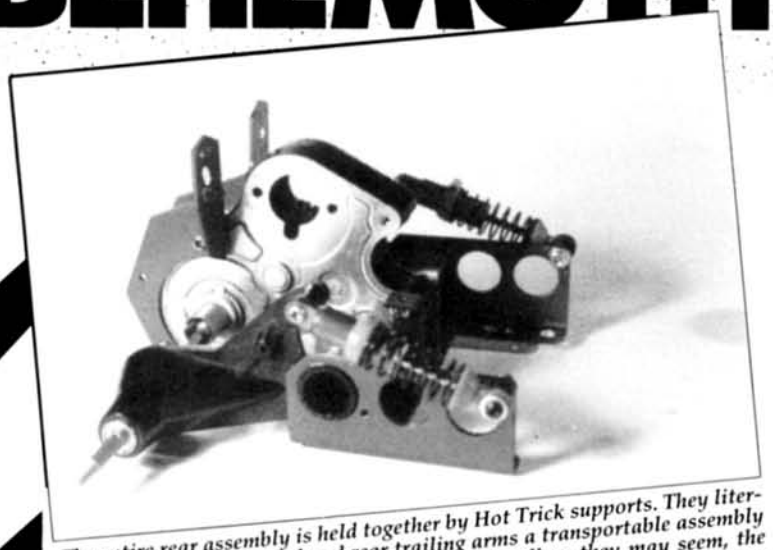
On the negative side, balsa wood is very vulnerable to damage. (I'm beginning to think that index cards are less fragile!) To counter that propensity, I coated the wood with K&B* epoxy resin. I mixed this with a small amount of catalyst to allow good first-coat penetration on both sides of the wood. It took almost a whole day to dry, but it toughened up the balsa quite a bit. Only the outside was given a second coat. On top of that, I used a white wood sealant and I coated that with clear epoxy—get the picture? Even so, it will take a scratch quite nicely if you give it half a chance. Styrene would have been a better choice, but I didn't have any around.

The front grill is flat brass stock made into a box with brass tubes across the front. The headlight buckets (and the front bumper/ram) were made from a discarded curtain rod, but anything similar will do. You can even opt for the original Blackfoot grill and save some time and work.

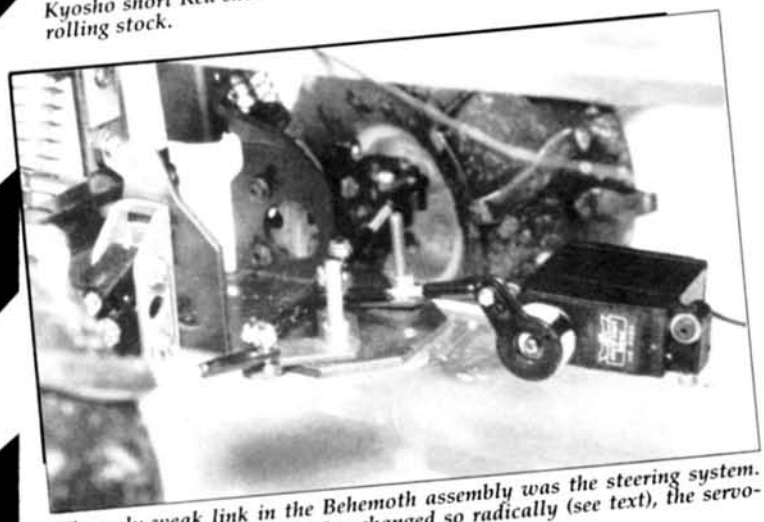
The rear bumper is taken from a pickup bumper design I saw in a truck magazine and, although the trailer hitch is inoperative, it wouldn't take more than a drill to remedy that. It's bolted to the rear differential through a CRP* bumper mount.



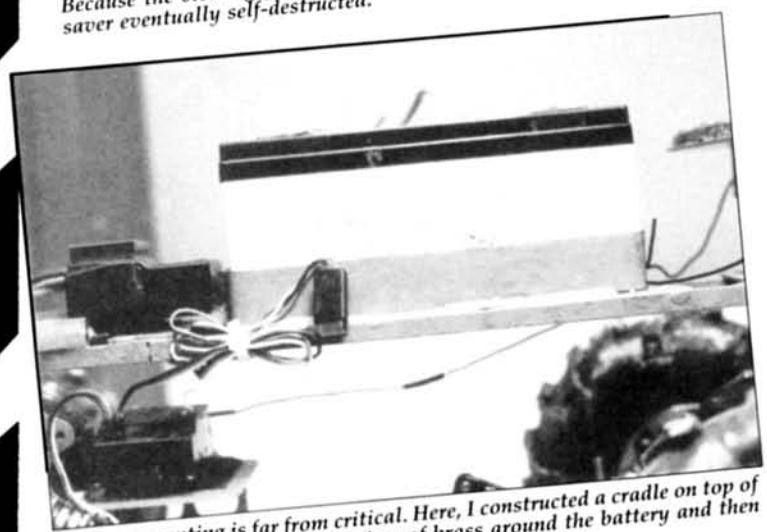
BEHEMOTH



The entire rear assembly is held together by Hot Trick supports. They literally make the differential and rear trailing arms a transportable assembly that can be moved from vehicle to vehicle. Small as they may seem, the Kyosho short Red shocks are more than adequate to handle the dual rear rolling stock.



The only weak link in the Behemoth assembly was the steering system. Because the steering geometry changed so radically (see text), the servo-saver eventually self-destructed.



Battery mounting is far from critical. Here, I constructed a cradle on top of the support bars by bending a piece of brass around the battery and then soldering it into place.

I brazed all the brass with a Radio Shack butane/nitrous oxide torch and acid-core solder. I'd never done anything like that before, and it took about an hour (and a few kind words from my younger brother, the welder) to get the correct amount of heat and solder to the right place at the same time. You'll probably ruin about two bucks' worth of brass figuring it out. (Warning: Solder that's been heated enough to join two pieces of metal is *very* hot. Wear eye protection and don't think the solder won't penetrate a pair of Levis. I have a burn on my leg that hasn't yet healed after a month—just caused by one small solder glob that splattered when I wasn't careful.)

If you don't want to work with fire, you'll have to notch the brass parts so they fit together and then use a good 5-ton epoxy to hold things together. It won't be as strong, but unless you run headlong into a wall, it should last quite well.

Improvements

No one says you can't use the original drive train from your Blackfoot. Doing it that way can give you a very satisfying project at a very low cost. (Figure if a 'Foot runs about $100, the extra differential housing and gears will cost another $35; the chassis blank, about $8; the extra pair of wheels and tires, about $25; a stock 540S motor, $12; and all the brass and balsa about $20—a total of about $200.

One of the first things I added were the Imex tires at $16 a pair. Bearings, of course, were the order of the day, both in the wheels and in the differentials, so I spent $35 on those. The Thorp Hot Shot differentials were a luxury. The pair of ball diffs (they fit fine), the counter gear, the dogbones and the wheel shafts tugged about $170 out of my wallet. They do add grip to the rear tires.

The LeMans 480G motors were another luxury. They're high torque and rated for 8 minutes. I'd like to have tried Trinity's* SpeedWorks monster-truck motors, but they weren't available at the time (but they are now).

I crowned the truck with a melange of radio parts. An Aristo-Craft* 402X servo

steers it, a Futaba* MC12B speed controller powers it, and a Kyosho Pulsar receiver takes all my inept commands from a Pulsar 2001 radio (I spend a lot of time making servo adapters). I had originally intended to use a Kyosho SC-1000 speed controller, but, at the last minute, I decided that it would be better if the truck had reverse (and I have another project coming up for the SC-1000 anyway).

Run Time

More than anything else, I had a bad case of butterflies when the truck was finally ready to run. I took it down to the local clay pond and fired it up. In the first two seconds, it was obvious that a single pair of front shocks wasn't good enough. As the Behemoth rumbled along the rough terrain (at a pretty fast pace), there were obvious clues that something wasn't quite right.

The bumps were sending the front tires off at incredible angles, inducing negative camber and severe toe-out. At best, the steering was tentative, and I managed to prove it by clipping a ground stake with the left front wheel while at full throttle. Luckily, nothing was really broken: The impact just tore the entire left-wheel assembly out of its mounting bracket, shearing two bolts in the process (a full-width front bumper would have helped, but that's hindsight). Not bad for 20 seconds of running!

In went new bolts and Nyloc nuts, and a larger running space (without ground stakes) was quickly found. The Behemoth was a joy to run. It has about a 5-foot turning radius—even with the unpredictable steering—and it builds to top speed fairly quickly. Nothing seems to bother it on the ground (except the errant wooden stake!); it just rolls on like something out of a "Mad Max" movie.

We had a bet going back at the office as to whether my Behemoth would be faster than a friend's High Roller, so I brought the truck in with me and we retired to an unused floor that's waiting to be rented. I'm happy to say, the Behemoth *is* faster than the High Roller. In fact, it's only about 25 percent slower than the

(Continued on page 122)

TROUBLESHOOTING

by FRED MURPHY

A little time in the pits gets you a lot of time on the track

IF I'VE HEARD it once, I've heard it a hundred times: "My car doesn't run." Keeping this in mind, let's talk about some basic daily maintenance.

After a hard day at the track, all car parts and the areas around the chassis will be covered with dirt and dust. When you look closely at the moving parts, it isn't difficult to recognize vulnerable areas that can ruin your performance if not properly maintained.

Before I get into how to keep your car clean, let's first take a look at the heart of the car—its power source. If the power source isn't up to par, find out why. Never overlook the obvious! The rechargeable nickel-cadmium (Ni-Cd) battery is the most taken-for-granted piece of equipment and, if not properly cared for, will ruin your enjoyment of this great R/C racing pastime. A 7.2V, 1200mAh flat-pack or hump-pack battery is able to push out more than 30 amps, which is equivalent to 200 watts. Neglecting this high-performance power source might lead to overheating or melting of the electrical cords, and it could permanently damage the battery or motor.

Short-circuiting is one of the most damaging faults of Ni-Cd batteries, and it occurs often. A short circuit will cause a large amount of electricity to flow in a short time, and this will generate heat, which might cause the wires or the pack to melt. An accident during racing may cause extraordinary loads on your motor, and this will have the same effect as a short circuit; it will damage the battery, the wiring, or the motor. After running your car, feel these components. If they're hot, let them cool off before recharging your battery or running the car again.

Overcharging is also a danger to your car's power source, because it rapidly shortens battery life, especially when continual quick-charging is usual. Many constant-current chargers with 15-minute timers charge at about 5 amps of current. This causes the nickel and cadmium to react chemically, and it rapidly produces gases. If charging is continued beyond the limit, the heat and gas generated will melt the casing or vent the chemicals, so it should obviously be avoided.

Overcharging can be avoided by using a separate voltmeter to monitor the charge, or by using a little common sense and not letting the battery get hotter than you can hold.

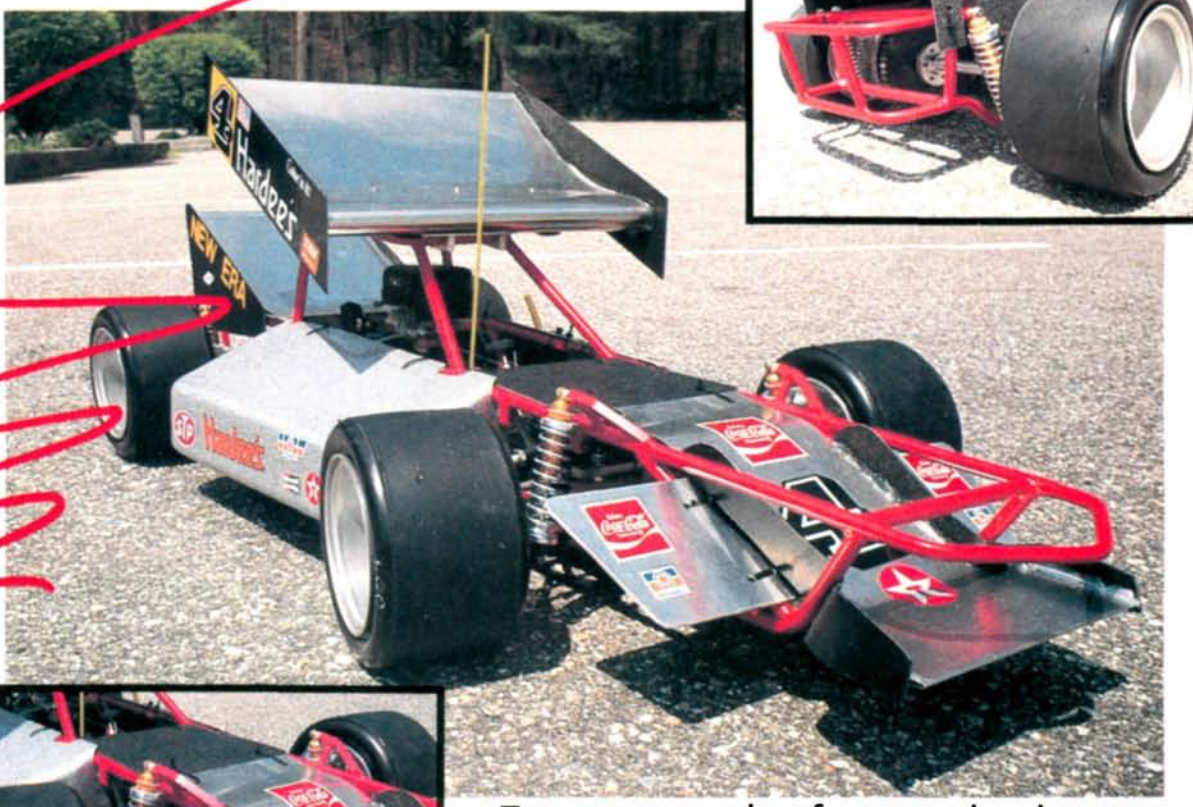
For virtually worry-free charging, use a 14- to 16-hour trickle-charger. If you're at the track with only one or two batteries, the heat build-up can be lessened by cooling the batteries on ice and charging them while they sit on it. Don't think, however, that you can take a hot battery out of a car that just came off the track, stick it on ice and immediately charge it—you *can't!* The ice will just speed up the cooling-off process.

If your car is equipped with a receiver battery box, be sure to check these batteries, too. Many modelers overlook this area when they're having control problems with their car. As a general rule, receiver batteries will be exhausted before your transmitter batteries. (Check out the article in this issue about replacing your receiver pack with a BEC.)

For optimum performance, daily maintenance is easy and essential. After brushing away excess dirt and dust with a soft-bristle paintbrush (I use one that came with my son's watercolor paint set), make sure that the areas around your car's ser-

(Continued on page 126)

NEW ERA EAST COAST SUPERMODIFIED



Twenty pounds of open-wheel action

by RICH HEMSTREET

FROM THE EAST COAST—the heart of modified and supermod racing—comes the New Era* 1/4-scale East Coast Supermodified. Open-wheel, paved, short-track racing's fastest machines are the low-slung, overpowered supermods. While the number of tracks racing supers has fallen greatly in recent years, the capital of supermodified racing remains Oswego, NY. New Era's car has a racing background that goes beyond geographic proximity; to build its cars, the company has enlisted the services of full-scale race car builders. The E.C. Supermodified's frames are assembled by welders who are used to working on full-scale racing frames. They know the importance of quality construction, because if their work is shoddy, a driver (often a friend) could be killed.

New Era's Supermodified uses a tubular steel frame that's triangulated and boxed for strength and rigidity. A rigid frame is a necessity for a properly functioning suspension system. The E.C. Supermodified has independent tubular A-arms up front. The solid rear axle is suspended by four radius rods and a pan-hard rod. This simple system is easy to adjust and provides plenty of rear suspension travel. Oil-filled coil-over shocks are mounted on all four corners of the car.

The 23cc Zenoah engine uses a chain for the final drive system, and ball bearings are found throughout the car. The large aluminum wing is easily adjusted for best handling, and a large disc brake provides the power to bring the super to a stop.

Watch *Car Action* for a full track report in the near future on New Era Models' East Coast Supermodified.

**Here's the address of the company featured in this preview:*
New Era Models, *P.O. Box 7378, Nashua, NY 03060.* ■

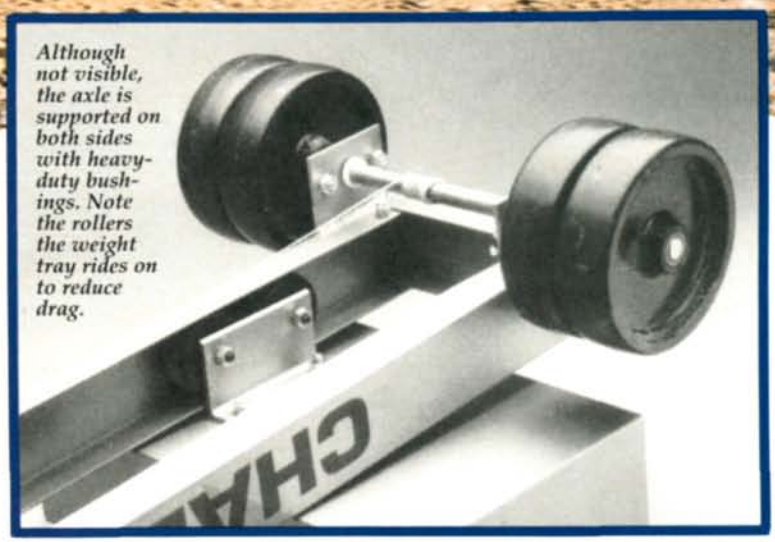
The front end of the Challenger sled (which is obviously made to take a beating) will pivot if the truck turns.

by STEVE POND

SINCE THE FIRST radio-control monster truck was introduced to the market, enthusiasts all over the world have been trying to emulate the activities of the full-scale monster trucks. These activities include mud bogging, hill climbing, car crushing—and the latest craze—sled pulling. While monster trucks aren't the only vehicles to hook up to the sled, they're the most readily available and hence the most popular pullers.

The A.J.'s Challenger sled is shown here being pulled by Jamie Krinsky's devastating Clod Buster. The sled is loaded down with a 90-pound rock!

Regardless of the vehicle, manufacturers and enthusiasts alike have been experimenting with different technology in an effort to pull more and more weight, and they've demanded stronger, more heavy-duty sleds to haul these massive loads. Until now, only one sled has been available to the pulling fraternity. While it works well with the box-stock trucks, the full-blown modified pullers can drag it around the track until the tires wear out. To answer the call of these ardent modified pullers, A.J.'s R/C* has introduced the new Challenger sled that can handle all the weight these pullers are willing to haul.

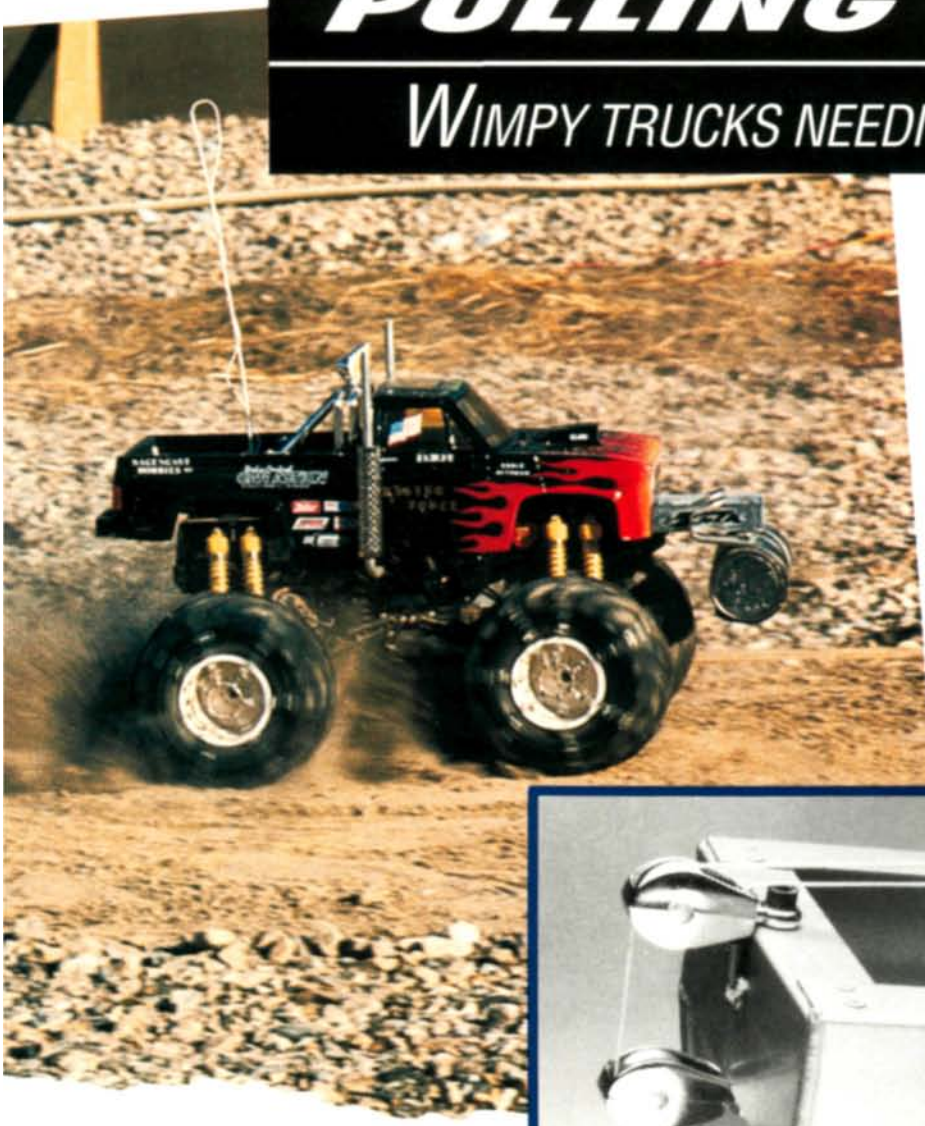


Although not visible, the axle is supported on both sides with heavy-duty bushings. Note the rollers the weight tray rides on to reduce drag.

The Challenger sled is constructed of strong, gold anodized aluminum with a 12x8x4-inch weight bed. The bed slides up and down a pair of aluminum channel rails on a set of rollers that ride inside the channels. Supporting the front of the sled are two heavy-duty aluminum channels that converge on a pivoting aluminum skid plate. At the front of the plate is a strong chain that even the hottest of pullers would have a hard time stressing. Supporting the back of the sled are two pairs of solid rubber tires that ride on a steel axle. This axle, which rides on bronze bushings, acts as part of the mechanism to transfer the weight

A.J.'S R/C CHALLENGER PULLING SLED

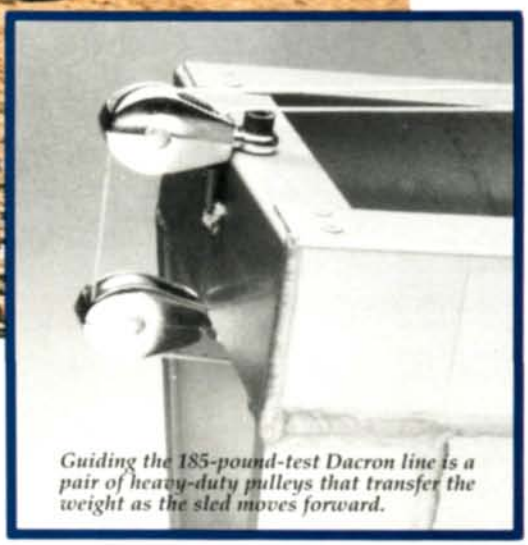
WIMPY TRUCKS NEEDN'T APPLY



to the front of the sled.

During a pull, a length of 180-pound-test Dacron fishing line is rolled around the rear axle as the sled moves forward. This line runs up through a pair of pulleys and back down to the weight tray. On the weight tray is another pulley through which the line passes and is finally anchored on the front of the sled. The total distance covered for the weight tray to reach the top of the slide is roughly 30 feet.

In an effort to test the manufacturer's conservative claim of a 150-pound capacity, we hooked the Challenger to a custom-built Clod Buster puller that will be featured in our Monster Truck Annual. In the dirt, we first loaded the sled with 55 pounds, which both the truck and the sled were able to handle, no sweat. With only a little more weight to put on the sled, we enlisted the help of an 85- and a 90-pound boulder. While the truck was starting to breathe a little hard, the Challenger was still taking it all in stride with a pair of full-pulls, finishing with the heavier of the two boulders. It's quite evident that it will take more than the likes of a radio-control sled puller to stress this sled! In fact, after we finished pulling, I stepped on the sled myself just to see if it would hold the weight. (I weigh 235 pounds!)



Guiding the 185-pound-test Dacron line is a pair of heavy-duty pulleys that transfer the weight as the sled moves forward.

For the ultra-heavy weights pulled when running on carpet, you might want to consider using a fishing cable to connect the weight tray to the axle to prevent the Dacron from stretching. (The amount of stretching is minimal and only at weights of better than 100 pounds, but it will still alter the length of the pull.) The size of the weight tray seems as large as you would want to make it, but you might be hard-pressed to find weights of more than 70 pounds that will sit inside the tray. I recommend making a number of lead plates, which will provide more than enough weight and will keep the center of gravity low for consistent pulls.

There's no doubt that this is the toughest sled we've seen that's available to the public. It should be able to handle anything that a 1/10-scale puller can throw at it. But, if you should happen to come across a puller that's a match for the Challenger, give us a call!

Here's the address of the company featured in this article:* ***A.J.'s R/C,* *2102 Guilderland Ave., Schenectady, NY 12306.* ■

MEATY, BEATY, BIG AND BOUNCY

ARISTO-CRAFT/POLK'S WILDEBEEST

LET'S FACE IT, Chrysler made a comeback by selling its K-car under a variety of different disguises, each subtly different from the other. If you can get away with it, it's a good practice, and if something is done in the real world, the odds are that, at some time, it will eventually appear in the scale world. That time is now! The Wildebeest is the latest in Aristo-Craft/Polk's* line of "animal" vehicles.

by BILL O'BRIEN

Introduced by Polk's as the 2WD Kangaroo and loosely modeled after a Tamiya* Frog/Lancia, Polk's did some redesigning and brought out a 4WD version called the Dolphin.This was a good car, but not spectacular, and it had the same basic chassis, but was driven by a chain at all four wheels. Now Polk's has finally found the correct place for its 4WD driveline and suspension and has dressed up the car as the Wildebeest monster truck. In fact, while I love my Blackfoot, the Wildebeest has many of its characteristics—and possibly a few more that you wouldn't usually expect on a 4WD truck.

CONSTRUCTION: Put away your

(Continued on page 47)

ARISTO-CRAFT/POLK'S

WILDEBEEST

Type ..... Off-Road Monster Truck
Scale 1/10
Sug. Retail Price $199.95

DIMENSIONS:
Overall Length ..... 18 inches
Width ..... 11.75 inches
Wheelbase ..... 10.5 inches
Front Track ..... 9 inches
Rear Track ..... 9.5 inches

WEIGHT:
Gross (w/bat. & radio) ..... 4.68 pounds

BODY:
Type ..... Pickup
Material ..... ABS

CHASSIS:
Type ..... Full-frame rails
Material ..... ABS

DRIVE TRAIN:
Type (pri./sec.) ..... Pinion-spur/chain
Differential(s) ..... Planetary gear
Bearings/bushings ..... Olite bushings

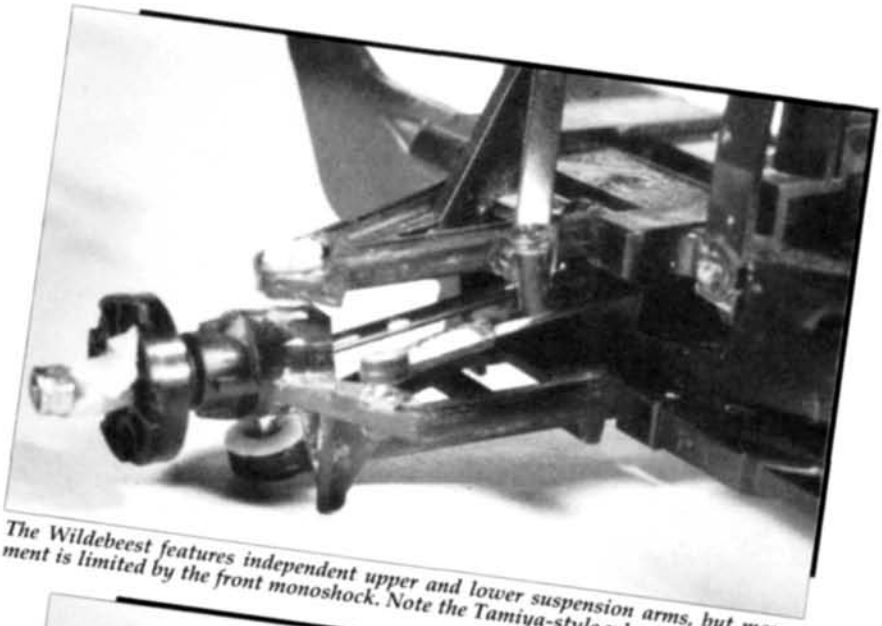
SUSPENSION:
Front: Type ..... Double A-arms
Dampening ..... Transverse mono-shock
Rear: Type ..... Trailing arm
Dampening ..... Coil-over shocks

TIRES:
Type (f/r) ..... Spiked terra
Dimensions (DxW) (f/r) ..... 4.5x2.25 inches

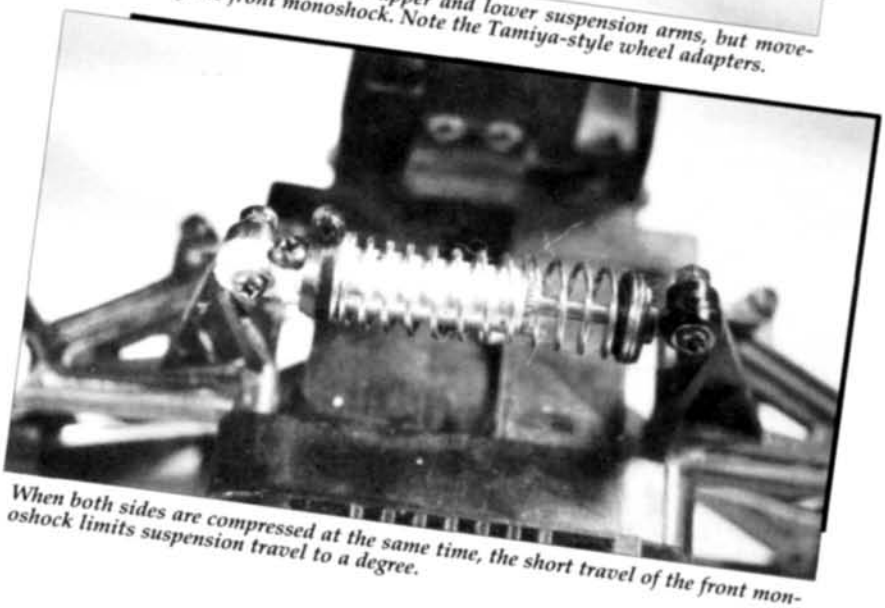
ELECTRICS:
Motor 540S
Battery Req'd. ..... 6-cell flat pack
Speed Controller ..... Aristo-Craft SP-0900 90amp MOSFET

OPTIONS AS TESTED:
Kyosho 6-cell 1200mAh battery, Parma Ford truck body. (All radio gear and the speed controller are included at the base price.)

COMMENTS:
The Wildebeest is *fun*. It's the only truck I own that's so willing to do wheelies at the drop of the throttle. It's huge bumpers are as imposing as they are protective. The only fault I could find was the short running time (just under 5 minutes). At the very worst, you can run the truck for a whole season and then junk the mechanical parts—that'll still leave you with excellent radio gear. But please, please, change the body.



The Wildebeest features independent upper and lower suspension arms, but movement is limited by the front monoshock. Note the Tamiya-style wheel adapters.



When both sides are compressed at the same time, the short travel of the front monoshock limits suspension travel to a degree.

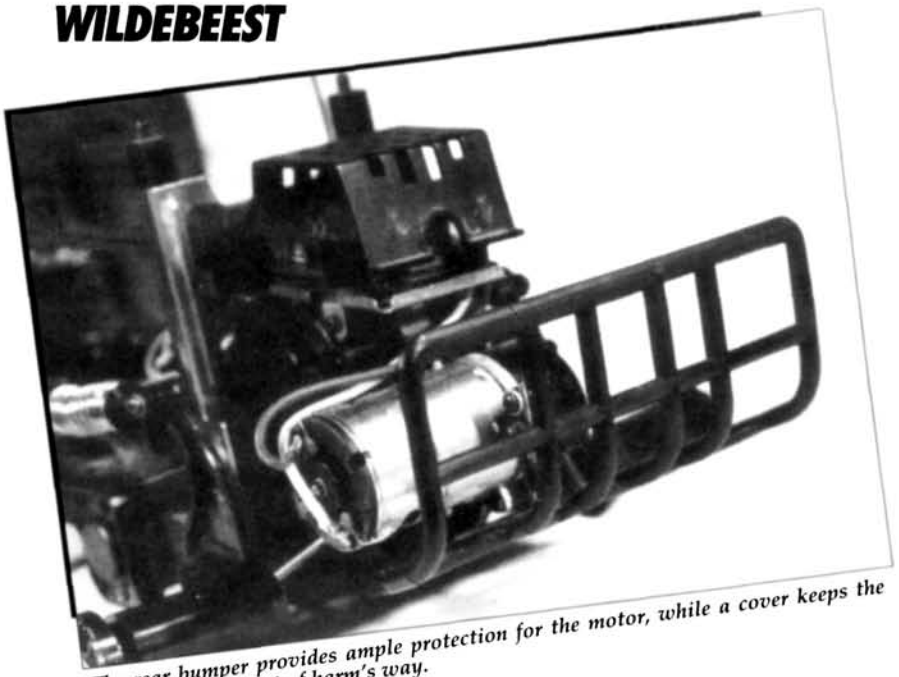
tools; the Wildebeest is assembled at the plant. It arrives in its own cardboard cage—not only all together, but also replete with all the radio gear (including an SP-0900 90-amp MOSFET speed controller) and a Challenger 250 stick radio. It's quite a bundle for $200, and some of its features are worth pointing out.

First and foremost is the stock Wildebeest body, which is the *ugliest* thing I've ever seen in all my years of looking at anything! Fully cast in blue (the windows too!), this body cries out to be covered in decals—and camouflage paint (and maybe a paper bag!). If there's a truck somewhere in South Korea that was used as the model for this body, I'd be embarrassed to own it. The first thing I did was replace it with a Parma* '50 Ford Custom body.

Underneath the ugly skin, the chassis is quite interesting. The basic design uses four cross-braced rails that completely enclose the chain-drive system. The upper pair is widened to provide a platform for the radio gear and the battery cover. The rear suspension uses short trailing arms with a single shock absorber on each side. The front is endowed with double A-arms and a single longitudinally mounted shock. In this configuration, the front shock acts more like an anti-sway bar, pushing a front tire down if the opposite one begins to lift.

Like many 4WDs, the Wildebeest is rear-wheel-drive, front-wheel-assist, i.e., the motor drives the rear differential, which then drives the front differential via

WILDEBEEST



The rear bumper provides ample protection for the motor, while a cover keeps the speed controller out of harm's way.

the chain. Not so common is the variety of gearing options that's possible with this arrangement. Effectively, the motor pinion gear drives an intermediate gear and a secondary pinion gear mounted on the same shaft. The secondary pinion gear drives the counter gear that motivates the rear differential. By varying the size of either or both pinion gears, you can create a nearly infinite choice of drive ratios.

While the entire drive system is sealed, lubrication hatches give you access to both the pinion and the chain. No major disassembly is needed, and as long as you screw the hatches shut again when you've finished, the system stays sealed. (Thirteen hours of running in dirt and mud failed to force any dirt into the driveline.)

One of the Wildebeest's most "intelligent" features is the metal brace that runs front to back between the front and rear body-mounting posts. Chassis flex is reduced to a minimum. And if you've ever worried about what happens when an irresistible monster truck runs into an immovable tree, fret no more. For protection, the massive front and rear bumpers extend well up into the body line. The tires are 5-inch beasts mounted on 2.25-inch Blackfoot-size wheels. In fact, the Wildebeest mounting pattern is identical to that of the Blackfoot's rear hubs, but the Wildebeest has thicker axles, while the wheels themselves have slightly less positive offset.

Polk's forethought also surprised me: Packed with the Wildebeest was a small plastic bag of spare parts, which included a spare dogbone, a counter gear, a few chain links and some screws and nuts. This makes a nice emergency field-supply kit.

As for the radio gear, a Polk's Challenger 250, 2-channel stick radio is standard with the Wildebeest. The transmitter itself is competent, but nothing spectacular, while the matching 2-channel receiver incorporates BEC circuitry. An Aristo-Craft Hitec 402X servo (another Polk's brand) rated at 42 ounces/inches moves the front wheels on command, and motive force is applied to the stock Mabuchi 540 by a sophisticated (read that to mean "lightweight") 90-amp MOSFET electronic speed controller.

PERFORMANCE: It's difficult to describe a monster truck's performance, because the typical acceleration, turning radius and top speed descriptions are really meaningless. The Wildebeest doesn't defy that generalization—with certain exceptions.

I have yet to run another 4WD vehicle, car, or truck that's so prone to doing wheelies. If you apply the throttle hard and the terrain is at all bumpy, the Wildebeest rears up on its back wheels like a wild stallion. I've had that happen with my 2WD Blackfoot, but it's a first for any of my 4WD vehicles. (Fortunately, the rear bumper acts as a huge wheelie bar that prevents the Wildebeest from rolling over onto its back like a beached turtle.)

And being 4WD does have its own advantages. If you send the Wildebeest up a slope, the spiked tires (à la the Monster Beetle) dig in at all four corners and "claw" their way to the top. You point the truck in the direction you want it to go,

press the throttle, and it goes there—no hesitation, no complaints.

Given a little running room, the Wildebeest will also pick up quite a lot of speed. It kept pace with my Blackfoot, but it didn't run quite as long, and run time was actually disappointing. The longest run was almost 5 minutes, and that was with a fully charged and peaked 1700mAh SCE battery pack. I get at least another minute from my 'Foot, and that has a mechanical speed controller.

Of course, the chain-drive system is partially to blame for this. Despite its light gauge, the chain imposes an unavoidable drag on the driveline. And the Wildebeest is chock full of bushings that just don't have the slipperiness of real ball bearings. (I should also mention that each of the Wildebeest's wheels and tires weighs in at almost .35 pound. Moving 1.4 pounds around also takes a lot of energy.)

What's Next?

Despite my complaints, I feel nothing but good will for the Wildebeest (so much so that I've cannibalized my Blackfoot into something else entirely). But nothing stays the way it came when *I* get it. One of my first changes will be to insert a LeMans 360ST motor, which is probably the cheapest (and best) truck motor around—and it's still a minor secret.

Gearing, of course, will be tampered with. Since Tamiya Frog pinion gears (not the extra-long, brass Blackfoot gear) will interchange in the differential, and because I own quite a few different pinion gears, I plan to do a lot of experimenting.

Next in line will be a set of bearings—*if* I can find them. With bigger axles, I'm not certain that stock Tamiya-size bearings will work with the Wildebeest. And the last thing on my list will probably be a shock absorber make-over. The monoshock up front needs to go, in favor of something a little more solid—perhaps a Kyosho* short Gold shock.

If you're looking to get into monster trucks with as little pain as possible, the Wildebeest might be good "gnus" for you.

**Here are the addresses of the companies mentioned in this article:*
***Aristo-Craft/Polk's,** 346 Bergen Ave., Jersey City, NJ 07304.*
***Tamiya/MRC,** 200 Carter Dr., P.O. Box 267, Edison, NJ 08818.*
***Parma International Inc.,** 13927 Progress Pkwy., North Royalton, OH 44133.*
***Kyosho;** distributed by Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.*

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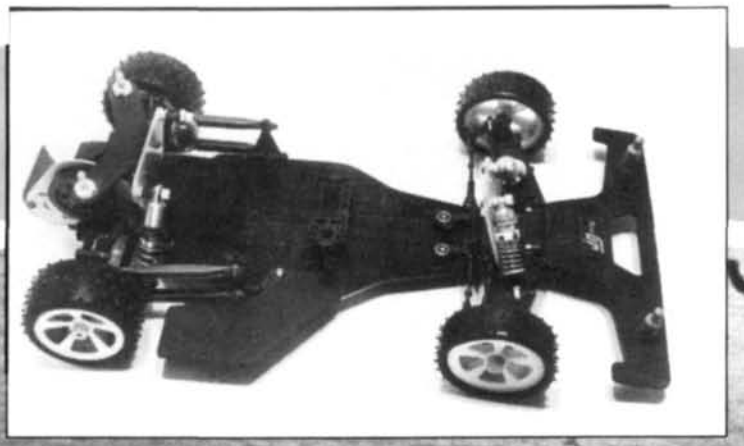


JG's Oval Conversion Kit for the Losi JR-X2 is installed and ready for the radio gear to join it.

JG'S JR-X2 OVAL CONVERSION

Transform Team Losi's off-road contender into a dirt-oval missile

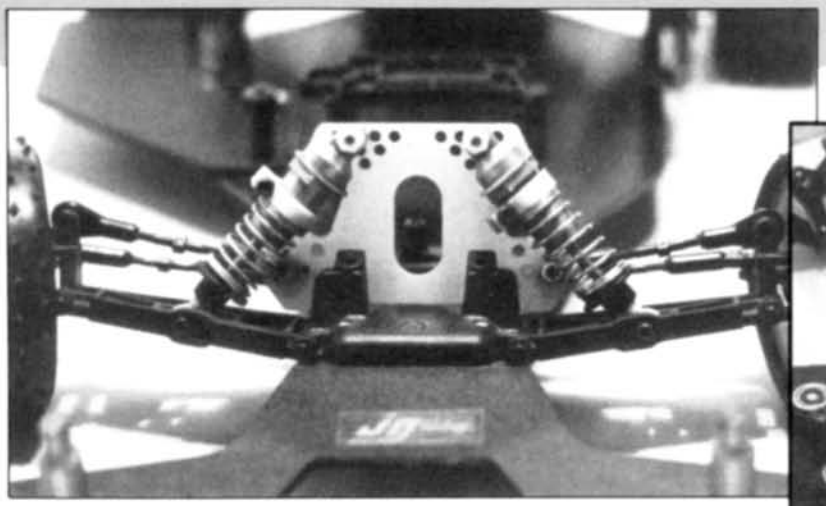
by WALLY DAVID

ON SEEING THE TEAM LOSI* JR-X2, my first thought was that it's a very impressive off-road car, and its success in races across the country has confirmed my first impressions.

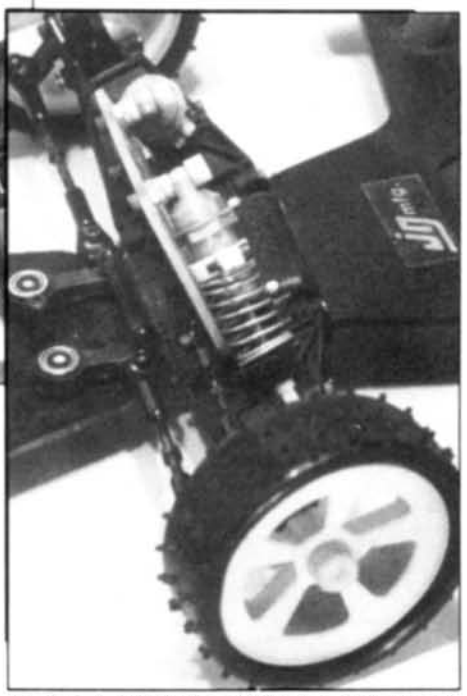
As things started to thaw out in the Northeast, my thoughts turned to the upcoming dirt-oval season, and then I started to wonder how the JR-X2 would perform as a dirt-oval car. Since I race in a full-body class, this raised more questions: How would I be able to lower the shock absorbers and change their angle so that a sleek wedge body would fit onto the car? How hard would it be to come up with an effective mounting system for the body?

Then, as if JG Manufacturing* had read my mind, I saw an advertisement for a JG Oval Conversion Kit for the JR-X2. Voilà! All my questions were answered. Since JG specializes in making after-market parts for oval racing, I knew this kit was for me.

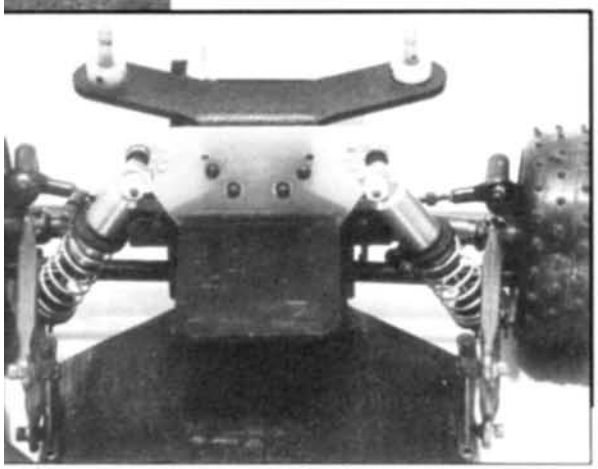
THE KIT: The conversion kit includes fiberglass front and rear shock mounts, a combination wide-front bumper/body mount, a two-point rear body mount, a right side nerf wing (or "wall-banger," as JG calls it) and a receiver/speed-control mount. Apart from the fiberglass shock mounts, all the parts in the kit are made of black



Above: Associated RC10 front shocks were attached to the new front shock mount. Multiple mounting holes give you many choices for shock location.



A Houge Enterprises Bellcrank and Parma Super Heavy Duty Rod Ends were installed. The stock ends were used between the bellcranks. They were threaded so that none of the rod was visible, and this provided the correct distance.



The new rear shock mount also lets you choose different shock angles. Note that the body mount is attached directly to the shock mount.

Kydex. All the necessary hardware and instructions are included, and you only have to add a pair of short shocks to lower the rear end. Associated* RC10, Kyosho* Gold or Team Losi shocks will work fine. I chose to use the RC10 shocks, because I already had them.

THE CONVERSION: The first step in the conversion process is the installation of the new front shock mount and the re-installation of the front shocks. Remove the front shocks and shock mount from the car, remembering to disconnect the upper control rods from the stock shock mount.

Using the holes that line up with the holes in the front bulkhead, install the new shock mount. To keep the rods parallel with the A-arm, re-connect the upper control rods with the lower, outermost hole in the new shock mount.

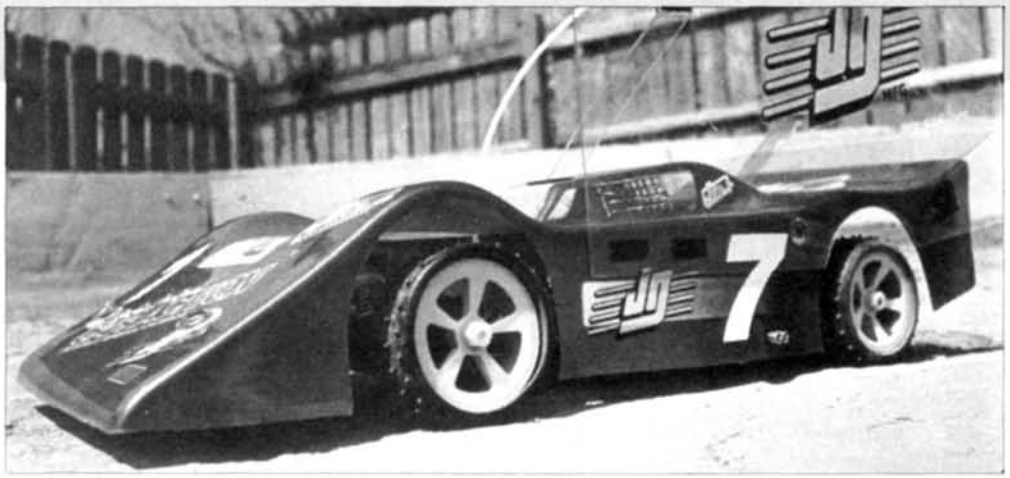
It's now time to re-install the front shocks. I decided to use the RC10 shocks up front, and I saved the front JR-X2 shocks for the rear of the car. If you use RC10 shocks, you'll have to remove the stock metal ball from the plastic end and replace it with one from the JR-X2 front shock end, so that the shock end will fit into the space in the front A-arm. The instructions for the front shock mount gave no information as to where the spacers and washers included in the kit should go. After some experimentation, I decided it was best to put the mounting screw through the hole that's second from the end on the top row. Thread a plain nut onto the screw, followed by two aluminum washers. Then add the white nylon shock bushing with the flange toward the mount. Slide the shock onto the bushing and secure it with the nylon nut. Now do this for the other shock. To dial the car into a particular track, some fine-tuning of shock location and spacing might be needed.

Now to the rear shocks. First, remove the rear shock mount and shocks, and put them away for off-road racing. (Remember to remove the plastic bottoms of the shocks, because you'll need them.)

The receiver/speed control mount is installed at the same time as the rear shock mount. Slip the two 4-40 cap-head screws through the holes in the receiver/speed control and into the bottom holes in the new shock mount. The two mounts are then attached to the rear bulkhead using the stock holes. Two flat-head screws also secure the mounts to the bulkhead. I replaced the flat-head screws with two 4-40 cap-head screws, because the flat heads stripped out very easily.

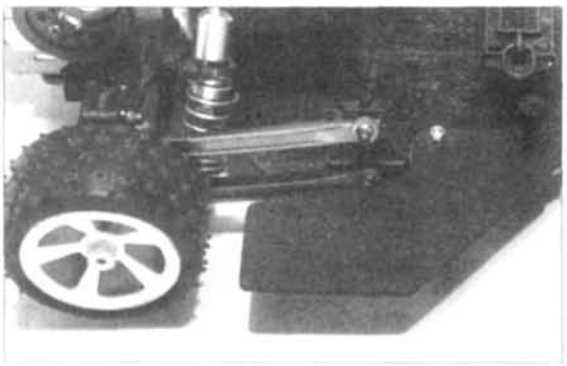
Thread the shock bottom onto the pistons of the shock. I used the JR-X2 shocks on the back, because the threads on the pistons fit the shock bottoms better than the RC10 shocks. Re-install the shock on the trailing arm. Using the upper, outermost hole, slide the shock-mounting screw through the shock mount from the back. Thread a regular nut onto the screw, and follow this with two aluminum washers. Pop the stock black plastic bushing into the top of the shock and then slide it onto the screw. Secure the shock with the nylon nut, and then repeat this procedure for the other side.

The front bumper/body-mount piece is very easy to install. Just remove the two



Left: The JR-X2 with the JG Oval Conversion Kit lurks under this sleek JG Outlaw Wedge.

front screws that hold the front bulkhead to the chassis, and install the bumper using these same screws and holes. Make sure that you install the bumper so that it's parallel to the ground and *not* pointing upward. Using the predrilled holes, the kit's black body posts are attached to the bumper.



Above: The right side nerf wing keeps unwanted guests out from under your car body.

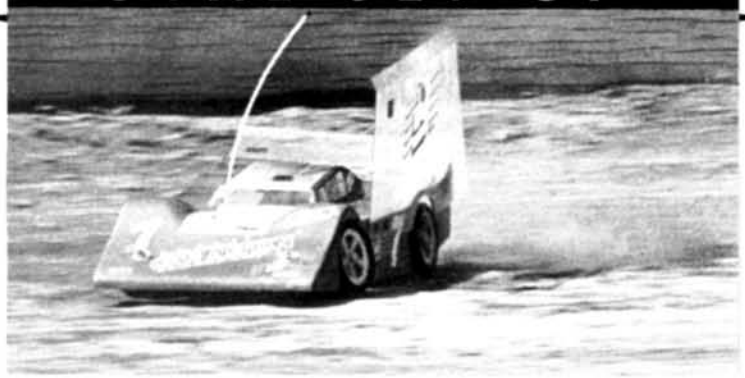
The rear body mount is attached to the gearbox. The tongue of the body mount fits into a slot on the top of the gearbox and is secured with two 4-40 screws and nuts. I substituted body posts made by Parma* as alternatives to the ones supplied. They're easily cut down to size, which in this case is pretty small.

As an alternative to installing the body mount on the gearbox, you can attach it directly to the shock mount. Simply line up the body mount on the shock mount and make marks for two new holes. Drill them out and bolt them onto the body mount. This will allow you to remove the gearbox without having to remove the body mount.

The last step in the conversion process is mounting the right side nerf wing, and for this, you'll have to drill a hole in the chassis. Mount the wing on top of the chassis with the wing pointing toward the rear wheels and attach it using the existing antenna-mount hole. Slide the stock, flat-head, Allen screw through the chassis and the wing, then thread it into the antenna mount. Position the wing so that the outer edge is parallel with the chassis, and drill a hole in the chassis using the hole in the wing as a guide. Secure it with the flat, Phillips-head screw and locking nut that come in the kit.

With that final step completed, the JR-X2 was ready for some oval excitement. I replaced the stock ball ends with the Parma Super Heavy Duty Rod End Kit for the RC10, and you might want to do this, too. While the stock

OVAL SET-UP

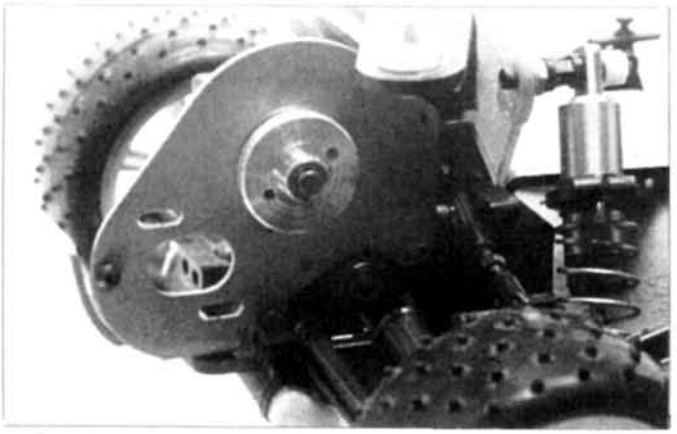


THE SHORT CLAY OVAL where I ran the JG JR-X2 conversion provides a real test of handling. Because of the short straights, much of your time is spent turning left, and this is the hardest part of racing. Going straight is easy!

After some experimentation, I came up with the following setup: To transfer the power to the track, I chose Imex Cat pin-spike tires for the rear. On the outside front, I used a narrow Imex Cat pin spike, while the inside front was a Pro-Line waffle tread. (During the photo shoot, I used a pin spike on the inside front also.) I had the shock collars cranked way *down* on the outside (right) front and the inside (left) rear shocks, and the collars all the way *up* on the inside (left) front and the outside (right) rear. This setup makes the car rock along a diagonal line from the inside rear to the outside front, and this allows the weight to be transferred to the outside rear tire. Because of this weight transfer, the car will want to turn to the left. If the inside front tire lifts off the ground, you'll know that you have it right. If the car wants to spin out, try to bring the collar back up on the inside rear, as this will restore some traction to the inside of the car. Above all, experiment! But *don't* make more than one change at a time, or you won't know what *really* worked.

ends seem pretty tight, I wanted to "bulletproof" my car. The Parma ends have a 4-40 screw that goes through the ball, so making sure that the end doesn't pop off in a collision. The turnbuckles included with the JR-X2 have the same 4-40 thread as the Parma rod ends, so once the turnbuckles have been installed, all adjustments are made by using the nut in the middle of the turnbuckle.

To beef up the steering of my JR-X2, I replaced the stock bellcrank with one made by Houge Enterprises*. It's actually designed for the RC10, but it can easily be adapted for the JR-X2. Simply drill out the holes in the chassis for the stock bellcrank pivots, so that gold RC10 Phillips-head screws will fit. Then follow the instructions in the package. I used screws that were flush with the top of the bearings in the bellcrank. The bearings fit onto the pivots so tightly that there was no need for a nut to keep the bellcranks in place. By running the tie rods from the steering block to the bellcrank, you can do away with the aluminum bar in the stock steering configuration.



The Robinson Racing Gear Adaptor allows you to use 64-pitch gears.

To run the car, I chose the high-tech Magnum PCM transmitter with a micro receiver and an S132H high-speed servo. The PCM stands for Pulse Code Modulation, and it virtually eliminates frequency interference. The signals from the transmitter are sent in digital pulses, and this means that they're the only signals the PCM receiver can accept. Look for Steve Pond's review of the Futaba PCM elsewhere in this issue.

I chose a Novak* T-1X electronic speed control to relay the power to the Checkpoint* 4016 16-turn motor. Since the JR-X2 comes with a 48-pitch spur gear, I used the Robinson Racing* gear adaptor, which enabled me to use the 64-pitch gears I already owned.

For the final touch, I needed a body that would fit the car. The JR-X2's front end is right to the ROAR-legal limit. This gives the car tremendous front-end stability, and it makes it difficult to fit the front wheels under a full body. After sizing up many bodies, I found that the JG Outlaw Wedge was a perfect fit. It seems to have been designed for the JR-X2, but in fact, it has been around for a few years.

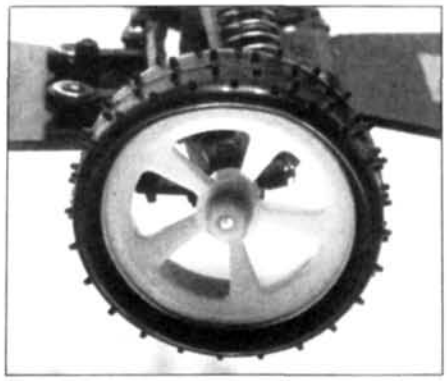
To finish the JG body, Bill Henning, of Henning Scale Models, used Pactra* paints. Most of the body was sprayed with Metallic Blue, and Pearl White was blended into Metallic Burgundy for the accent stripes. Autographics* makes some neat decal sheets for detailing bodies. I think the dual-exhaust, quick-fill gas-tank opening, radiator mesh, window netting, and hood pin decals make for another level of realism.

Speaking of hood pins, I used Bud's* Locking Hood Pins to keep the body on the car. I also used Dan's RC Stuff* Body Foams to prevent the body from cracking around the mount holes.

The big Lexan side air dam and rear spoiler are made by Andy's R/C Prod-

(Continued on page 54)

JR-X2 CONVERSION



Imex Cat tires were mounted on the stock JR-X2 rims. The pin spikes provide great traction on hard, dusty tracks.

ucts*. The side dam helps the car cut through the turns more easily.

Well, the JG Oval Conversion Kit did what it was supposed to. The shock mounts allowed me to angle the shocks in at the top, so lowering the ride height while retaining the proper spring tension. The nerf bar, receiver/speed-control mount, and the rear body mounts all did their jobs.

The only major problem is with the front bumper/body mount. The Kydex seems too thin to take the abuse that the car will inevitably endure on a short oval. I've had to bend up the bumper repeatedly to keep it from dragging on the ground. While thicker Kydex would add more weight (which is what we're always trying to avoid), having a sturdier bumper seems more important.

With the JG conversion kit on my JR-X2, I look forward to making *a lot* of left-hand turns during this dirt-oval season!

**Here are the addresses of the companies mentioned in this article:*

Team Losi, *1655 E. Mission Blvd., Pomona, CA 91766.*
JG Manufacturing, *P.O. Box 6014, Whittier, CA 90609.*
Kyosho, *distributed by Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.*
Associated Electrics, *3585 Cadillac Ave., Costa Mesa, CA 92626.*
Parma International Inc., *13927 Progress Pkwy., North Royalton, OH 44133.*
Houge Enterprises, *2300 Sand Lake Rd., Orlando, FL 32809.*
Novak Electronics Inc., *128-C E. Dyer Rd., Santa Ana, CA 92707.*
Checkpoint Racing, Inc., *729 W. 16th St., B4, Costa Mesa, CA 92627.*
Robinson Racing Products, *501 Peach, Santa Ana, CA 92704.*
Pactra, *410 N. Michigan Ave., Rm. 1280, Chicago, IL 60611.*
Autographics of California, *7401 White Lane, #1, Bakersfield, CA 93309.*
Bud's Racing Products, *P.O. Box 601, Amherst, OH 44001.*
Dan's RC Stuff, *9255C Cozycroft Ave., Chatsworth, CA 91311.*
Andy's R/C Products, *466 W. Arrow Hwy., Unit K, San Dimas, CA 91773.* ■

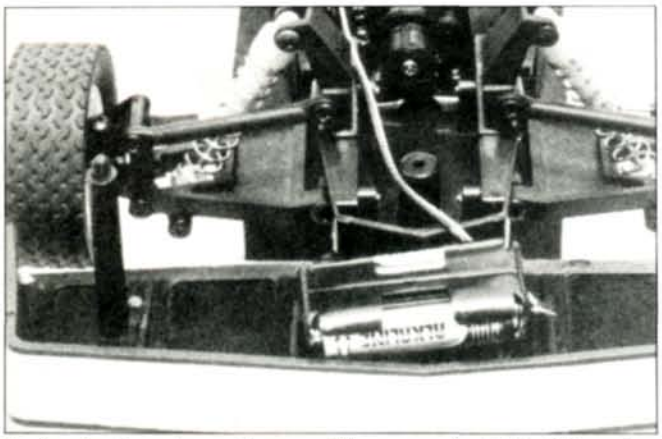
by WALLY DAVID

GLOBAL HOBBY DISTRIBUTOR

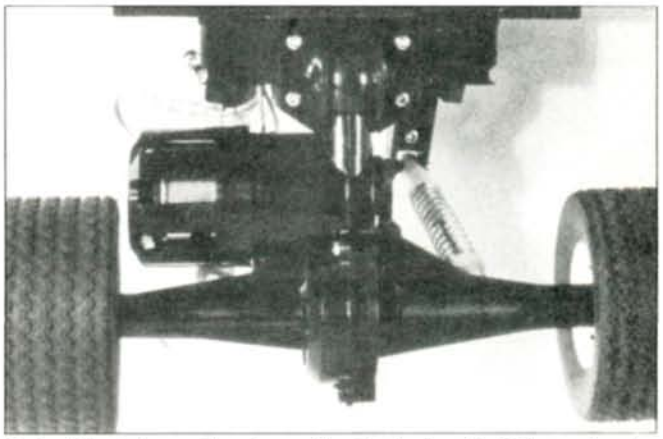
PANDA STOCKER

Entry-level NASCAR thrills for the cost of a full-scale tire

FULL-SCALE STOCK-CAR racing undoubtedly has the largest number of competitors nationwide. From 1/4-mile, flat, dirt ovals to high-banked superspeedways, full-bodied stock cars go fender to fender, swapping sheet metal, each driver pushing his car to the limit with hopes of victory. Now Global Hobby Distributors* is bringing that excitement to R/C racing with its Panda Stocker. The Stocker is aimed at the beginner who doesn't have access to professional on-road 1/10-scale tracks (whether carpeted *or* high-banked pavement), but you can run the Stocker out of the box on parking lots, playgrounds, driveways, etc., without having to buy different tires.



The front end uses lower A-arms with upper control links. This system maintains proper camber of the front tires. Notice the location of the receiver's battery pack.



Underside of the gearbox shows the plastic pivot ball that makes for a fluid rear suspension. The motor guard protects the wiring.

THE KIT: The Panda Stocker kit consists of an ABS plastic tub chassis, coil-over friction shocks on the front and rear, upper control link and lower A-arm independent front suspension, a pivot-ball live rear axle, a sealed planetary gear differential, an RS 540 powerplant, bronze Oilite bushings, treaded (on-road-type) rubber tires and a sharp, clear Lexan Chevrolet Monte Carlo stock-car body. Also part of the Stocker kit is a massive front bumper with body posts; all that's needed to complete the car is a 2-channel radio and a 7.2V flat battery pack (hump packs won't fit).

ASSEMBLY: The instruction manual is clearly illustrated, and the written instructions are basically descriptions of the illustrations. I was able to build most of the car just by looking at the pictures, although I advise you to read the instructions anyway. There's some confusion because, although the instructions refered to "labeled parts bags," none of the bags was labeled! Life-size drawings of the different screws and pins in the kit would have been helpful.

Construction begins with the front end, which has a modular design, i.e., when the front end is complete, it's bolted to the chassis. The A-arm control-link setup is similar in design to the front end of the Associated* RC10 in that it has an A-arm to which an upright is connected. The control link runs from the upright to the shock tower, and this enables the front tires to retain the proper camber while handling bumps in the road. In many entry-level cars, the front tires have a tendency to point inward or outward at the top when the suspension is compressed—not so with the Stocker.

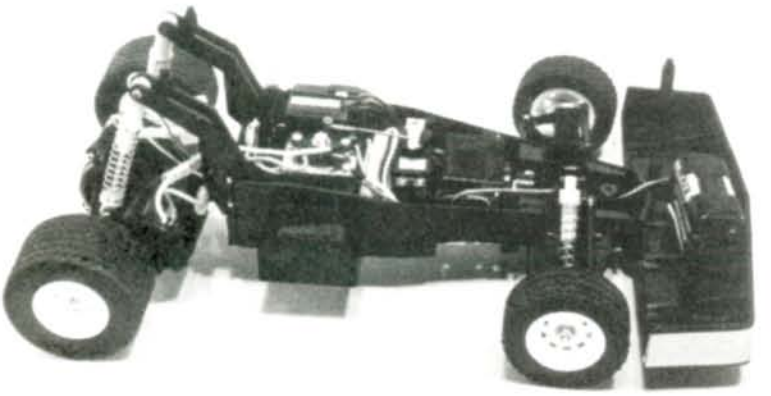
After the front-suspension assembly has been attached to the chassis, the huge front bumper (the largest I've ever seen!) is installed. The front body posts are mounted to the bumper, creating a rock-solid way to mount the full body that's included in the kit. Many entry-level cars need an after-market kit with which to mount full bodies, but the Stocker doesn't.

Construction continues with the gearbox assembly. The instructions are very straightforward from here on out; just remember to apply the grease supplied everywhere the diagrams indicate. The bronze Oilite bushings included for use in the gearbox are a *great* improvement over the plastic bushings that come with most kits. The performance of the gearbox is very smooth, because the Oilites have little play (slop), and they also last much longer than plastic bushings. A pivot ball attaches the gear-case assembly to the chassis. The large plastic ball that's a molded part of the gear case should be generously lubricated and then placed against the cup on the bottom of the chassis. The ball-joint cap is then screwed into place, thus allowing an extremely fluid rear suspension.

Oilite bushings in the front wheel provide smooth rotation.

When the chassis and suspension have been completed, it's time to install the wheels and tires. Oilite bushings are used in the front wheels. Although they have the word "oil" in their name, these bushings still need a little lubrication to give optimum performance; compared with plastic bushings, they seem to spin forever. The Stocker comes with very soft rubber tires, and the soft compound and the tread pattern combine to produce very high traction. The instructions recommend the use of CA to hold the tires on the rims. I didn't glue them on at first, and I regretted that decision as soon as the car hit the track.

The installation of the three-step mechanical speed control led to some confusion. The instructions and diagram describe the speed control as if it came completely unassembled, and it took me a while to decipher from the rather unclear diagram what was going on! In fact, the only wires that had to be attached were the positive and negative battery leads.



The Panda Stocker protects your radio gear with its tub-style chassis design.

The negative lead (white in my kit, but black in the diagram) was attached to the plate with a small nut and bolt. The positive lead was attached by a 3x10mm self-tapping screw to the plate, which was, in turn, secured to the speed-control mount. There was no *real* need for the overly detailed diagram and instructions.

The KO Propo EX-7 radio chosen for this car came with a servo and receiver that fit into place perfectly. The only problem was the receiver battery pack. The Stocker kit only allows the use of radio systems with a BEC (battery eliminator circuit), but the KO Propo unit doesn't have it. In most cars, this wouldn't be a real problem. However, because of the chassis cover, there's absolutely no room for the battery pack, and this necessitated the placement of the pack all the way up front inside the front bumper. It affected the handling of the car...but more on that later.

The final step was preparation of the clear Lexan Monte Carlo stock-car body. This comes with an exterior coating of plastic film that protects the Lexan from being scratched while preparing the inside of the body for painting. The film also eliminates the need to mask the outside of the body before painting, since any overspray that gets onto the film will be peeled away when the film is removed. (I'm sure it would be greatly appreciated if more manufacturers adopted this practice.) Body painter extraordinaire, Bill Henning of Henning Scale Models in Lansdale, PA, did another fine job. The number and sponsor decal sheet provided served as a good base for the 7-UP paint scheme. The 7-UP decals are made by Parma*. Attached to the red chassis cover, the driver figure adds a nice look to the interior. With the body very securely positioned on the mounts, it was off to test the Panda Stocker.

PERFORMANCE: The Stocker's first test was on an asphalt parking lot. The Bear (as I've affectionately renamed the Panda) took to the "asphalt jungle" just as a real-life bear takes to the forest. The tires seemed to have just the right amount of bite (pun very much intended!) for this Panda. There was a little high-speed understeer (push) in the front end; even with the receiver battery box all the way up front for extra weight, the car didn't always want to turn. The coil-over shocks absorbed the bumps very nicely.

For the second test, I made a trip to the local carpeted roadcourse to see what the Stocker could do. After the first turn, there was no evidence of understeer. As a matter of fact, the front tires dug in so well that they popped right off the rims. Remember what I said about gluing the tires onto the rims? After a quick trip to the pits for some CA, it was back to the carpet for more laps. With the receiver battery pack all the way up on the front bumper, the weight proved to be too much, and this caused the car to spin out. This was quickly cured by moving the pack toward the middle of the car and securing it with double-sided servo tape. With the weight more evenly distributed, the car handled very well, and the responsive steering made the Stocker very easy to drive.

For a final test, I took the Panda Stocker to a local dirt-oval track. The manufacturers claim that the car will work on flat dirt, but my track test proved otherwise. The rear of the car wanted to come around on the slightest touch of the trigger. Maybe a change of tires would help, but out of the box, this is no dirt car. Well, you can't have *everything!*

(Continued on page 135)

PANDA

STOCKER

Type ..... On-road
Scale 1/10
Sug. Retail Price $134.95

DIMENSIONS:
Overall Length ..... 18 inches
Width ..... 9 inches
Height ..... 5.5 inches
Wheelbase ..... 10.25 inches
Front Track ..... 7.75 inches
Rear Track ..... 7.125 inches

WEIGHT:
Gross (w/bat.) ..... 50 ounces

BODY:
Type ..... Monte Carlo stocker
Material ..... Lexan (clear)

CHASSIS:
Type ..... Tub
Material ..... ABS plastic

DRIVE TRAIN:
Type ..... Pinion/spur gear
Differential ..... Planetary gear
Bearings/bushings ..... Bronze oilite bushings

SUSPENSION:
Front: Type ..... Lower A-arm, upper control link
Dampening ..... Coil-over friction shock
Rear: Type ..... Live axle with pivot ball
Dampening ..... Coil-over friction shock

WHEELS:
Front: Type ..... One-piece plastic
Dimensions (DxW) ..... 1.5x.75 inches
Rear: Type ..... One-piece plastic
Dimensions (DxW) ..... 1.5x1.5 inches

TIRES:
Front/Rear ..... Rubber w/tread

ELECTRICS:
Motor 540
Battery Req'd. ..... 7.2V flat pack
Speed Controller ..... 3-step with reverse

OPTIONS AS TESTED:
KO Propo Ex-7 radio with two standard servos.

COMMENTS:
Excellent beginner's on-road-style car. Oilite bushings are a great improvement over plastic bushings in other kits. Perfect car for urban area or for those who don't have specially built tracks available to run on. Wouldn't be competitive against direct-drive pan-style on-road cars.

TRAXXAS VILLAIN IV

by CHRIS CHIANELLI

Make waves with your off-road equipment

SINCE WE'VE RECEIVED so many inquiries about some of our boat articles, we've decided to give you another look at the world of electric fast boats. Traxxas Corporation* of Dallas, TX (a company that's probably familiar to most of you for its cars, e.g., the Cat, the Fiero GTP and the new Bullet), has now brought us a twin-motor, surface-drive, deep-vee, off-shore racer called the Villain IV. The Villain IV we received from the manufacturer was a completely built model with a radio, but a kit without a radio will also be available. When you remove the ready-to-run Villain from the box, there's very little work to be done. Put on the decals, glue on the chrome railings, and that's about it!

PHOTO BY LOUIS DeFRANCESCO Jr

Features

Gear-reduction surface drives are some of the Villain IV's very desirable features. A surface drive reduces the load on the motors, allowing them to unwind and realize their full rpm potential. This also reduces the amperage draw, thereby increasing run time, and it allows the use of a larger, more efficient prop.

There are heat sinks on the motors, and the assembled unit has an electronic speed controller that has two huge heat sinks. This electronic speed controller is very capable of handling two 7.2V battery packs. It has adjustments for neutral, and it has a brake (though I'm not quite sure why

OCEAN MOTION!

Left: Chris Chianelli goes over control functions with Ms. Allison Redmond.

Below right: The Villain demonstrating excellent stability in the turn.

you'd need a brake on a boat).

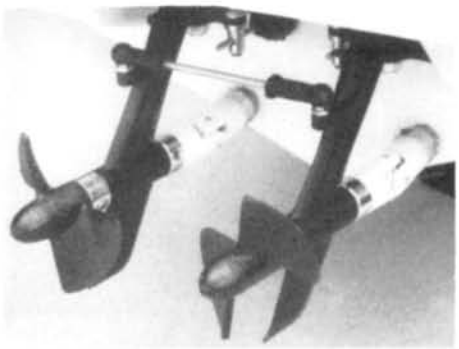
The deep-vee hull, which handles rough water very well, has "planing strakes" on it, which are ridges that run from the bow toward the stern. These planing strakes have made the Graupner* line of fast boats very competitive, so Traxxas has obviously done its homework.

The twin props are set up so that they counter-rotate, and this is advantageous. In a surface drive, the bottom half of the prop is the only part that's submerged, i.e., only the bottom arc is in the water, and it tends to push the transom in the opposite direction to that in which the the bottom of the props are spinning. The problem is worse with a twin when both props are rotating in the same direction. (This is known as "transom-walk.") The boat will turn better in one direction than the other, and they'll need corrective trim to run straight, and this causes unwanted drag. Counter-rotating props eliminate this problem.

Opposite rotation is accomplished by having a counter gear on one drive unit. However, I think Traxxas will be reversing the polarity on one of the Mabuchi 540s motors in-

(Continued on page 63)

stead of the counter gear. This is probably a good idea, since the counter gear did part company with the drive transmission after a couple of runs, and also because the use of the extra gear creates more drag. If you happen to buy a Villain with a counter gear, it's easy to eliminate the need for it by removing it and adjusting the motor so that the pinion is in direct



The surface-drive units, complete with universal joints, can be equipped with ball bearings. The center idler arm that connects the two drives reduces slop. For forward movement, propeller on left moves counterclockwise, while propeller on right moves clockwise. This must be reversed. (See text.)

mesh with the main spur, as is the case on the starboard drive unit.

An alternative simple solution (one I'll talk about in another article) is to take advantage of the Clod Buster after-market motors—the two motors operate in opposite directions. Trinity* makes both stock and modified Clod Buster motors that should work well in the Villain. Viewing these motors from the pinion-gear side, you'll see that one rotates counterclockwise (like most motors) and the other rotates clockwise.

There's a very convenient spring contact mounted in the radio compartment, which is soldered to the receiver antenna wire. This mates with a contact plate on the bottom of the radio compartment hatch, which, in turn, is connected to the external whip antenna. Hatch removal is quick and easy: Simply remove the four butterfly bolts that hold down the radio-compartment hatch. The two drive units have a 2:1 gear ratio and are very similar in design to the successful Graupner units, but their motors are mounted in front of the transmission instead of behind it like the Graupner units. There are also trim-angle adjustment bolts on the outdrives, so you can adjust the outdrive angle to suit any running conditions you encounter. Inside the radio compartment, there's a cradle for the two flat-pack batteries, and there's a strip of Velcro to hold them down.

There's a little package of goodies that includes things like lubricant and glue for the railings, and extra screws and nuts, in case you happen to lose one (and most of us have lost a screw or two because of vibration). Seems I always have a screw loose! There's also a silicone T-pipe to facilitate simultaneous oiling of the two drive-shaft tubes. Just stick the lubricant into the end of the tube; the oil goes down into the drive-shaft section and lubricates the Oilite bushings in the shaft tubes.

The steering linkage is set up and has only minimum drag. There's also a center linkage rod between the outdrive units, and this greatly reduces slop and vari-

WHAT'S THE CONNECTION?

IN THE PAST year or so, *R/C Car Action* has featured a number of articles on R/C electric race boats. There are a number of reasons for this, the most obvious being that these boats are fun to race, they're fast and there's a lot of "crossover" from R/C cars to R/C boats in terms of support equipment. The chargers, batteries and hot motors that are already used in 1/10-scale cars can be used in fast electric boats as well.

In addition, the twin-stick radios that you bought early on in your R/C car career—the ones that are probably collecting dust in your basement—can now be put to use with boats. By talking to modelers, we've learned that these twin-stick radios are thought of more highly when considered for use in electric fast boats. This makes a lot of sense, because the oval-type courses on which boats typically run have no tight hairpins, S-turns, or chicanes. There are, however, plenty of *jumps*—especially in rough water!

The electronic equipment required for boats and cars is strikingly similar. Any car speed controller, whether coil-wound, step-resistor, or electronic, can be used in an electric boat. However, try to avoid running your boat in salt water, because it will give you all sorts of headaches. Unlike the first-time R/C electric boat buyer, the experienced car enthusiast already has the major—often expensive—equipment, and he or she understands the radio and battery technology needed to successfully get a boat away from shore. To get started, all you really need are a hull, a drive unit and a pond. ■

Wanted:

AUTHORS
CONTRIBUTORS
PHOTOGRAPHERS

We think a lot of our readers have ideas that are worth sharing. How many times have you read an article and said "I could do that!" or "That's not the only way to do that; mine's easier!" Could very well be! Here's your chance! We'll be expanding **Radio Control Car Action** and are looking for additional contributors to help us accomplish this objective. Of key importance is the ability to take good photographs; the writing we can help you with. Interested? It's much easier than you might think.

Let's hear from you. Send in your ideas, articles, thoughts and photos; we're looking forward to it.

RICH HEMSTREET
R/C CAR ACTION
AIR AGE PUBLISHING
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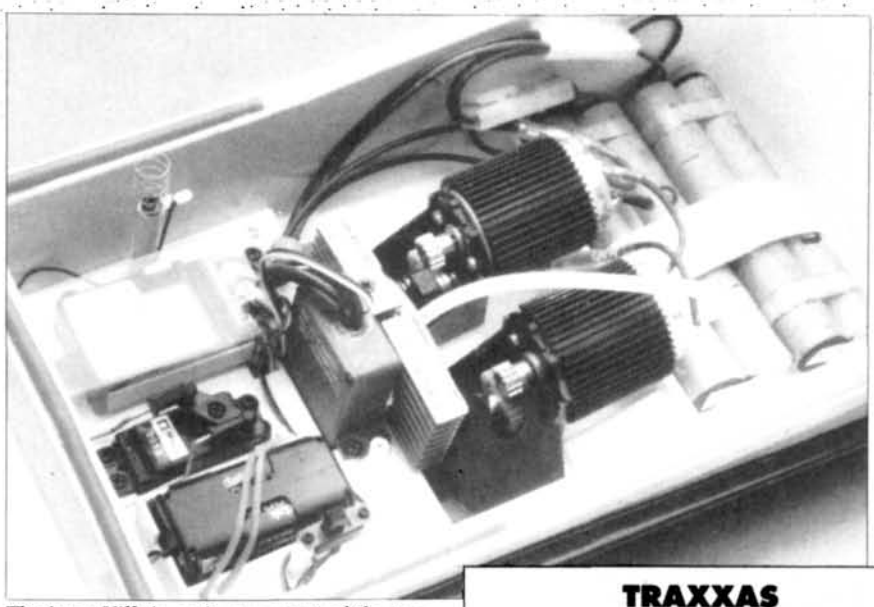
TRAXXAS VILLAIN



The inner Villain as it comes out of the box (less batteries). Note the heat sinks on both the speed controller and motors. A Velcro strap holds the Ni-Cds in place. In the upper left side is the spring-contact, which mates with a plate on the bottom of the compartment hatch which, in turn, connects to the outside antenna. See text.

ations between the two units. (This helps to maintain precise steering.)

Ooops!

The only mistake I found on the Villain IV (apart from the counter gear previously mentioned) was that the counter-rotating props were set up so that their bottoms (the parts in the water) rotated toward each other. They should actually rotate *away* from each other, because this reduces cavitation, and both props aren't then competing for the same water. Cavitation is actually what it sounds like: A cavity of air forms around the props. The easiest way to remedy this stock setup is by reversing the polarity of both motors and then swapping the two props.

The Villain comes set up so that first-time boat modelers don't get in over their heads; it also provides a long run time. Its performance isn't all it could be, and this is partly the result of the low-pitch "sport" props. In other words, they aren't racing props. But never fear; the Villain has the right ingredients to become a good racing boat. High-performance props are a necessary addition, and they're available from Octura*. All Octura electric racing props and adaptors will fit the Villain, so you're all set!

The Villain's motors can also be upgraded. As I said before, pairs of motors made for the Clod Buster should work

TRAXXAS

VILLAIN IV

Type ..... Offshore racer
Sug. Retail Price ..... $320 RTR with radio
$185 kit, without radio

DIMENSIONS:
Overall Length ..... 31 inches
Width ..... 8.25 inches

WEIGHT:
Gross (w/bat.) ..... 3.5 pounds

HULL:
Type ..... Deep-Vee
Material ..... ABS plastic

DRIVE TRAIN:
Type (pri./sec.) ..... Twin, steerable surface drives, counter-rotating props
Ratio 2:1
Motor ..... Twin RS-540S
Speed Controller ..... Fwd and rev. electronic
Radio ..... 2-channel twin-stick w/servo-reversing
Battery Req'd. ..... Two 7.2V stick packs
Run Time ..... 8 to 10 minutes

OPTIONS AS TESTED:
None

COMMENTS:
The Villain is an excellent value, as it will supply the novice boat racer with a docile deep-vee hull that can be upgraded for racing as the owner's skills improve. While the stock Villain's speed is only moderate, high-performance motors and props can be added for much greater speed. The direction of the counter-rotating prop must be reversed to cut down on cavitation.

well. The motors for the Hyperdrive belt system, which requires a counter-rotating motor in some applications, could also be naturals for this boat when matched with the same regular-rotation motor. So the Villain can be set up for all-out racing, which is what we're all after, isn't it?

Performance

Beginners can feel comfortable with the Villain, because the inner hull is packed with Styrofoam, and in an accident, it won't sink—even if it *completely* fills with water!

The Villain's moderate performance not only gives newcomers a boat that's easy to handle, but, with its sleek, racy lines, it's also quite exciting to watch and to run. Its performance can be improved as your skills progress, so you won't have to buy a new boat if the urge to compete strikes you. It throws a big rooster-tail, and it's very stable as it cuts through the H_2O in tight turns—although we did encounter a few exciting spin-outs during testing, so don't get the impression the Villain is slow—it's just not as fast as it *could* be.

I took the Villain through some choppy water to see how it would perform. Just like a full-scale, off-shore racer, this deep-vee design really shines in the rough stuff.

Some Suggestions

I'd like Traxxas to reverse the direction of the prop rotation to get rid of the cavitation problem. It would be a major improvement, but it's really a small thing, considering the easy fix. With its rakish appearance, the Villain seems to beg for some hot, bolt-on performance goodies, but we'll save all that for an article in an upcoming issue. Would you believe, "Project Villain"?

**Here are the addresses of the companies mentioned in this article:*
Traxxas Corporation, *12150 Shiloh Rd., #120, Dallas, TX 75228.*
Graupner; *distributed by Hobby Lobby International, 5614 Franklin Pike Cr., P.O. Box 285, Brentwood, TN 37027.*
Trinity, *1901 E. Linden Ave., #20, Linden, NJ 07036.*
Octura Models, *7351 N. Hamlin Ave., Skokie, IL 60076.* ■

INSTALL YOUR OWN BATTERY ELIMINATOR CIRCUIT

RETIRE YOUR RECEIVER PACK

by MIKE LEE

YOU CAN MAKE your R/C car lighter by eliminating the on-board radio battery and replacing it with power from the main battery pack. While most radios have plastic battery boxes designed to hold 4 AA cells to power the receiver and servos, virtually no one uses these for racing. There are a couple of ways to eliminate this receiver battery weight. Some newer receivers have built-in Battery Eliminator Circuits (BEC) that allow the use of the motor's 6-cell battery pack. If your radio doesn't have BEC, you can use either dropping diodes or a voltage regulator to deliver the correct power supply from the car's battery pack to the radio system.

It's easy to install one of these weight-savers. The items needed are a soldering iron, a wire stripper, a wired connector for the receiver, and either a Radio Shack 4005 diode or 7805 voltage regulator. Begin the operation by removing the receiver battery pack from the car. After removing the batteries from the case, cut off the connector that goes from the battery pack to the receiver. Leave the connector fully intact along with its switch, if that's an integral part. Now, at the main battery connector of the car (the one on the car, not on the battery), take a small screwdriver and push in the tabs on the connecting pins inside the connector block. This will allow you to remove the pin from the inside of the connector.

Remove the red wire and connector first. Solder the diode to the red wire connecting pin without disturbing the primary wire. Pay attention here: The diode is polarized; that is, it works only in one direction. If you hook it up incorrectly, it blows out. Look for a small white band at one end of the diode. That's the positive end and it is *not* the end to solder to the connecting pin! Go ahead and solder the diode to the pin. Now take the red wire from the receiver connector and solder it to the diode on the end with the white band. You're halfway there.

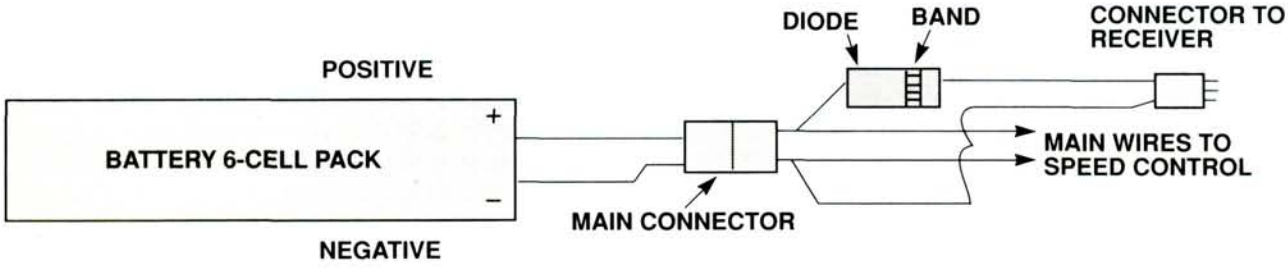
Push the pin back into the connector block and then remove the black, or negative, wire and pin from the connector block. Solder the black wire from the receiver connector to this pin. When done, reinstall the pin into the connector block

At this time, check to see if:

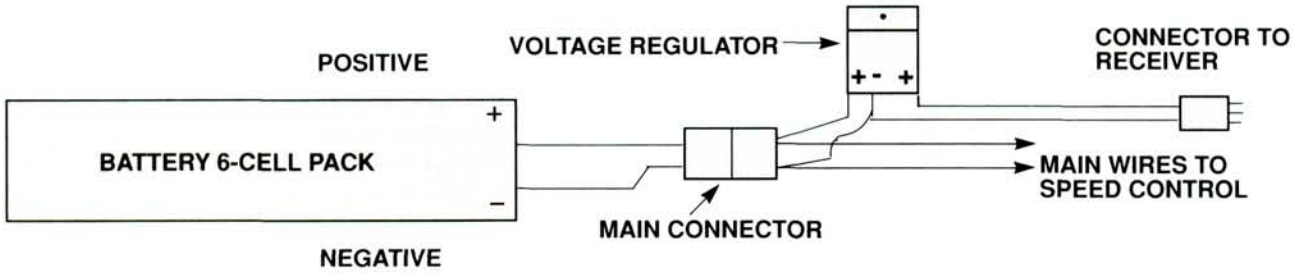
- the red wire from the connector block has the diode soldered to it with the white band out, and the white band side soldered to the red wire of the receiver connector
- the black wire from the connector block is soldered to the black wire of the receiver connector
- all solder joints are clean and neat with no big globs of solder that might touch each other.

If all these things are correct, pat yourself on the back. It's all done and you're ready

(Continued on page 70)



There are two ways to set up your BEC: above, using diode; below, using voltage regulator.



(Continued from page 66)

to hook up the car and run.

To use the voltage regulator, solder a short piece of red receiver wire to the red connector pin. Now solder this wire to the left-side terminal of the voltage regulator. You might want to use some heat-shrink tubing to insulate the terminal and wire connection. Solder the red wire of the receiver connector to the right-side terminal of the voltage regulator. Next, install a piece of black receiver wire between the black connecting pin and the middle terminal of the regulator. Then solder the black wire of the receiver connector to the middle terminal. That's all there is to installing a voltage regulator. Be sure to retain an on/off switch in the system to enable you to cut current to the receiver.

What you've done is tap radio power from the main motor battery. The result will be a car that operates as well or better, since you'll actually be supplying a bit more voltage to the radio. However, there's a price to be paid for this conversion.

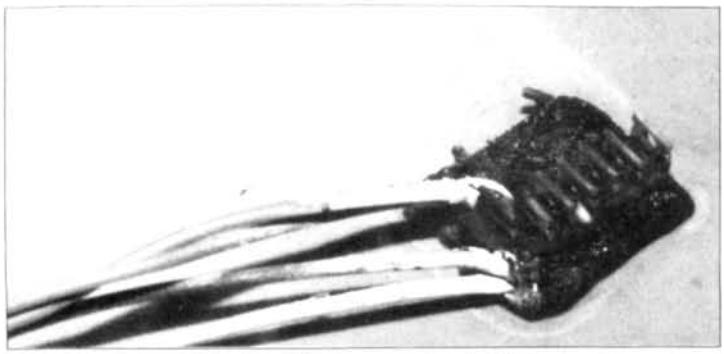
When running this type of setup, you'll eventually run out of juice from the car's power pack. And when this happens, the radio will also be running low on power. If you keep trying to run the car, both radio and motor will run down, with the radio signing off first. That means control can be lost, so it's important to watch for signs of dumping. Thankfully, our rechargeable batteries run down suddenly, and you'll see the car start slowing down. When it does, make a pit stop and recharge the battery pack. The single-diode setup is for cars using 6-cell packs; a 7-cell pack requires a second diode to be installed. The voltage regulator works with both 6- and 7-cell battery packs. In fact, the voltage regulator is ideal for dragsters, as it will take up to 30 volts input. That means you could use 20 cells or more for some really quick, scale, quarter-mile runs. Try this little tip and save some weight. It could mean a faster, better-handling car. ■

Volt! Ohm! Amp! Watt??

INTRO TO ELECTRONICS

by JOHN RIST

ELECTRONIC TERMS, such as volt, ohm and amp, used in the specification of motors, batteries and speed controllers can be very confusing to the first-time car builder and even to the experienced modeler. The more you know about these terms, the easier it will be for you to become an informed component shopper for your electric car. And any time you can learn more about a hobby, the more enjoyable it becomes. More and more technical articles require some electronics knowledge to determine if the article is the gospel according to Ohm's law or just pure bunk. Who knows? If you learn enough about the hobby, you might design a car that's fast enough to beat those dreaded RC10s or the hammering Turbo Ultima!



Don't smoke your speed controller!

Here are the terms that I'll discuss:

- volts, amps, ohms
- watts, power rating
- amp hour rating vs. run time

Volts, Amps and Ohms

Georg Simon Ohm (1787-1854) discovered the relations that control the flow of electricity. These relationships are known as Ohm's law, which states: To find volts, multiply amps by ohms.

The best way to understand this relationship is to compare an electrical system to a tank of water with a hole in the bottom (See Fig. 1). The tank represents a battery, the water in the tank represents electricity, and the hole in the tank allows water to flow, which we can relate to electric current flow. The height of the water in the tank represents the volts of the battery. The higher the water, the greater the pressure pushing the water out of the hole. Likewise, a 8.4V battery has more driving force than a 7.2V battery. The water flowing out of the hole is a good representation of current flow (amps). The taller the tank, the greater the pressure and the greater the water flow. The same is true for a battery system: Higher voltage yields higher current flow measured in amps. Ohms are best represented by the size of the hole in the water tank. The larger the hole, the lower the resistance and the greater the water (current) flow. If the bottom of the tank was missing, all of the water would flow out at once. This is the equivalent to a dead short across a battery, which dumps all of the current (high amps) at once.

All the components in an electric car's motor system have some resistance. The speed controller acts as a variable resistor. When its resistance is high, the car goes slowly because of the low current flow. When the resistance approaches zero or a dead short, the car goes fast. Even when the speed controller is turned on hard (dead short, zero resistance), the current flow in the system is determined by the resistance of the motor. It's always desirable to keep the resistance of the speed controller, battery and wiring as close to zero as possible. This keeps the unwanted power losses to a minimum. The motor must contain some resistance in order to keep current flow at a safe level.

If you know any two of the items in Ohm's law, you can calculate the third. Here are some examples:

- Determine the voltage drop across a speed controller if there's a current of 12 amps flowing and the throttle on the transmitter is depressed to the point that yields a resistance of .5 ohm in the speed controller. To find volts, multiply amps by ohms (volts = amps x ohms): 12 amps x .5 ohm = 6 volts. In this example, 6 of the available 7.2 volts of a 6-cell pack would be dropped across the speed controller, and the motor would run very slowly with only 1.2 volts across it.
- Determine the resistance of a motor that has 5 volts applied across its input terminals and has 11 amps flowing through it. To find resistance in ohms, divide volts by amps (ohms = volts ÷ amps): 5 volts ÷ 11 amps = .45 ohms. The resistance of this motor would be .45 ohms.
- Determine the current (amps) that's flowing through a motor that has a resistance of .3 ohms and is connected to a 6V

(Continued on page 80)

TRC/TRINITY CHALLENGE

WET AND WILD AT WHIPPOORWILL

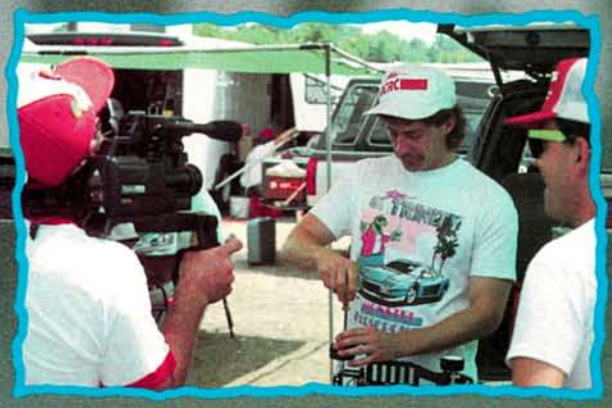
by RICH HEMSTREET

Left: Gary McAllister, foreground, is busy judging the Concours competition while onlookers inspect the Parade of Cars.

Right: Orville Coates captured 3rd place in the McAllister Concours contest with his Folgers Monte Carlo.

Right: Mike Giesen won 1st place in True Concours with the Neil Bonnett No. 21 T-Bird.

Left: Whippoorwill's Parade of Cars circled the entire track under threatening skies.

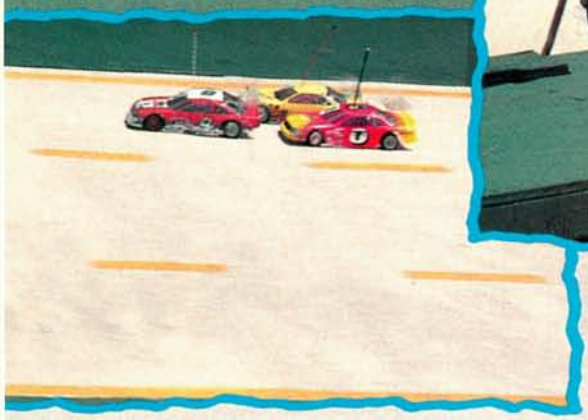


Right: One of Car Action's ten best drivers for '89, Tony Neisinger is now a member of Team Trinity.

LAKE WHIPPOORWILL INTERNATIONAL SPEEDWAY recently hosted the TRC/Trinity Challenge. In addition to the traditional Friday night Novak 650, the Invitational drivers took part in 7-cell, 5-minute, 1/10-scale racing and in 6-cell, 5-minute, 1/12-scale racing. The amateur drivers ran a 6-cell, 4-minute format for both 1/10-scale stock and modified classes.

The interest in 1/10-scale high-speed racing continues to grow. Composite-Craft had its new Lynx II on the track, but they wouldn't let me take pictures of it. TRC continued to experiment with its "Morton Radials," the new rubber-

Left: When T-boned at 40mph, even R/C cars receive some damage, but the driver is never injured!



The high groove isn't the fast way around Whippoorwill, and when three cars are up there together, a crash is sure to follow—and it did.

Right : Steve Stifel (left) and Howie Ursaner discuss the quickest way around the track.

TRACKSIDE

BRADLEY BLOSER CAME all the way from Charleston, SC, to race at Lake Whippoorwill for the first time. At only four years of age, Bradley is the youngest driver ever to compete at the track. A milk crate was placed on the drivers' stand so that Bradley could see over the rail. His dad, Steve, acted as a spotter for the young racer. Bradley finishing 9th in the Stock M-Main.

WHILE TRINITY WAS a co-sponsor of this event and Speedworks Superspeedway motors were handed out to the Stock Class drivers, representatives from Twister Motors were actively helping racers in the Stock Class get the most out of their motors. An informative manual from Twister was handed out to all the stock entrants. This manual provided technical information, ranging from a basic explanation of motors to information about gearing, brushes and springs. Mike Walker was on hand to answer technical questions for the racers. Mike explained, "We're really going to try to help the average racer at all the major races we attend this year." Way to go, Twister!

AKIRA AKOGAWA OF JAPAN was on hand, both to race and to cover the race for RCM, the Hi-Per Magazine. RCM is a major R/C magazine in Japan (not to be confused with the U.S. magazine of the same title). Unless you read Japanese better than I do, you probably won't learn much about the race in RCM. Akira did take home the trophy for winning the McAllister Best Paint Concours.

Akira and I were scheduled to have a writer-versus-writer shootout, but that got scrubbed, partly due to weather, and partly because I let it die after seeing the amount of Reedy horsepower that Mike had bolted into Akira's 10L. Besides, I was driving Bob Hosch's used racer, and it only finished one race with all four tires still attached!

capped tires. Many drivers, including Joel Johnson, used the new motors from Redline Motors. BoLINK's LTO chassis was used by many of their drivers for the 4- and 5-minute races, and Tony Neisinger used Trinity power on the high-banked speedway for the first time. Hyperdrive's production model Hyper 10 and Associated's 10L were both on hand.

With 107 entries that included seven of the drivers that made *Car Action's* Ten Best Drivers of 1989, this was the largest group of Invitational drivers to have assembled for a Whippoorwill event. More than 200 amateur entries rounded out a full race schedule.

Unfortunately, heavy rains interrupted the racing several times during the weekend. A Friday afternoon rain curtailed practice time for the amateurs and Invitational qualifying; Friday night, the Novak 650 was shortened when the skies opened up again; Saturday afternoon was washed out by a tremendous downpour that left several inches of water standing in the center of "Whippoor*pool* Speedway." (A 6-foot crocodile was even spotted in the infield, which turned out to be the inflatable kind.) This was the first time that rain had caused a problem at one of Whippoorwill's major events.

At the drivers' meeting held Saturday morning, Bob Hosch wanted to know how many drivers were racing at Lake Whippoorwill for the first time; about 40 drivers raised their hands. It's great to see these racers willing to enter a major race at the best-known R/C track in the world. This is another sign that 1/10-scale, on-road oval racing is continuing to grow rapidly.

In addition to weather problems, there was also a problem with the AMB scoring system. At one point in the qualifying, one of the car's on-board electrical systems was giving off so much interference that it locked up the AMB and stopped counting the cars. This was the first time Rick Jordan of BoLINK (the AMB distributor) had ever encountered a car that was capable of shutting down the system. Later, the "black box" on the Autocount bit the dust. Qualifying was put

Jill Simms, Modified winner

Cliff Lett, 1/10 Invitational winner

Kevin Lanier, Stock winner

Kent Clausen, 1/12 Invitational winner

on hold for a little over an hour while another box was picked up.

In all, the TRC/Trinity Challenge was the most difficult race the Whippoorwill crew had ever run. When the qualifying was finished, Kent Clausen sat on the pole for the 1/10-scale Invitational Class. Clausen's Reedy-powered Associated 10L completed 50 laps at an average speed of 42.99mph. Clausen's teammate, Cliff Lett, also driving a Reedy-powered 10L, was second fastest; Lett recorded 49 laps at 42.5mph. Doug Laurent rounded out the top three, driving one of CompositeCraft's new Lynx IIs. Laurent also used Reedy power for his 49-lap, 42.23mph qualifier.

Clausen also captured the pole for the 1/12-scale Invitational Class with an almost identical time. He drove his Reedy-powered Associated 12L to a 50-lap run at 42.99mph. Clausen's 10L run was actually .01 seconds quicker than his 12L. Obviously, his consistency is hard to beat on the big oval. Shawn Ireland was second fastest, running his Reedy-powered 12L at 42.22mph in a 49-lap qualifier; he averaged 6.20 seconds per lap. Dave Hechler, driving a TRC Pro 12 with Trinity power, was only a tick-of-the-clock slower, averaging 6.21 seconds per lap on his 49-lap run.

A record was set during one of the 5-minute, 1/12-scale Invitational qualifiers Then Eric Soderquist, driving his Twister-powered 1/12-scale Agitator, recorded a 5.63-second lap. Unfortunately, Soderquist couldn't maintain that pace and ended up only sixth fastest overall.

In the Amateur ranks, Darryl Reich was the top modified qualifier, driving his BoLINK to a 40.9mph average speed. His Quarterflash motor took him 38 laps to earn the pole position. Tuffy Carrigg drove a Trinity-powered TRC to earn the outside, front-row starting position with a 40.65mph average. John Neimcovic captured the third fastest time driving his Fantom-powered McAllister car 40.4mph.

TRC/TRINITY CHALLENGE A-MAIN WINNERS

Invitational 1/10 A-Main

Finish	Qual.	Driver	Chassis	Motor	Tires	ESC	Body
1	2	Cliff Lett	Associated	Reedy	Associated	Novak	Associated
2	8	Paul Davis	CompCraft	Redline	TRC	Tekin	BoLINK
3	4	Chris Doseck	CompCraft	Trinity	TRC	Novak	BoLINK
4	1	Kent Clausen	Associated	Reedy	Associated	Novak	Associated
5	9	Orlando Milian	CompCraft	Redline	TRC	Novak	BoLINK
6	10	Art Carbonell	Vicfor	CAM	TRC	Novak	BoLINK
7	3	Doug Laurent	CompCraft	Reedy	TRC	Novak	BoLINK
8	7	Dave Hechler	TRC	Trinity	TRC	Novak	BoLINK
9	6	Joel Johnson	CompCraft	Redline	TRC	Novak	BoLINK
10	5	Dennis Vindedahl	TRC	Twister	TRC	Tekin	BoLINK

Amateur 1/10 Modified A-Main

Finish	Qual.	Driver	Chassis	Motor	Tires	ESC	Body
1	6	Jill Simms	CompCraft	CAM	TRC	Novak	BoLINK
2	7	Joseph Randow	CompCraft	Redline	TRC	Novak	BoLINK
3	5	Nathan Wincek	CompCraft	Redline	TRC	Novak	BoLINK
4	1	Darryl Reich	BoLINK	Quarterflash	BoLINK	Novak	BoLINK
5	9	Mark Gillen	BoLINK	Quarterflash	BoLINK	Tekin	BoLINK
6	8	Joe Higgins	CompCraft	Redline	TRC	Novak	BoLINK
7	2	Tuffy Carrigg	TRC	Trinity	TRC	Novak	N/A
8	10	Stephen Miniea	CompCraft	Redline	Twinn-K	Tekin	Andy's
9	3	John Nemcovic	McAllister	Fantom	TRC	Tekin	McAllister
10	4	Frank Trinchitella	CompCraft	CAM	TRC	Novak	BoLINK

Amateur 1/10 Stock A-Main

Finish	Qual.	Driver	Chassis	Motor	Tires	ESC	Body
1	1	Kevin Lanier	BoLINK	S	BoLINK	Novak	BoLINK
2	5	Matt Dahm	TRC	P H	TRC	Novak	BoLINK
3	8	Tuffy Carrigg	TRC	E A	TRC	Novak	N/A
4	7	Steven Dunn	TRC	E N	TRC	Novak	BoLINK
5	2	Toni Hartley	CompCraft	D D	TRC	Novak	BoLINK
6	6	Ricky Jordan	BoLINK	W -	BoLINK	Novak	BoLINK
7	4	Tony Carrigg	CompCraft	O O	TRC	Novak	BoLINK
8	3	Jill Simms	CompCraft	R U	TRC	Tekin	BoLINK
9	10	Jim Bartok	CompCraft	K T	TRC/KRP	Novak	MRP
10	9	Frank Trinchitella	CompCraft	S	TRC	Novak	BoLINK

Invitational 1/12 A-Main

Finish	Qual.	Driver	Chassis	Motor	Tires	ESC	Body
1	1	Kent Clausen	Associated	Reedy	Associated	Novak	Associated
2	2	Shawn Ireland	Associated	Reedy	Associated	Novak	Associated
3	5	Chris Doseck	CompCraft	Trinity	TRC	Novak	BoLINK
4	9	Bud Bartos	TRC	CAM	TRC	Novak	BoLINK
5	8	David Timmerman	TRC	CAM	N/A	Novak	BoLINK
6	4	Terry Rott	CompCraft	CAM	TRC	Novak	BoLINK
7	3	Dave Hechler	TRC	Trinity	TRC	Novak	BoLINK
8	7	Steve Swindle	BoLINK	Wimpy	BoLINK	Novak	BoLINK
9	6	Erik Soderquist	Agitator	Twister	N/A	Novak	N/A
10	10	Jim Fuller	CompCraft	Reedy	TRC	Novak	BoLINK

NOVAK 650—SORT OF!

THIRTY-FOUR INVITATIONAL drivers raced each other in hopes of landing one of the ten starting positions in Friday night's Novak 650. The 650 laps around Lake Whippoorwill represent 50 actual miles of R/C racing. On top of that, the 650 takes place at night, under the lights.

In a 125-lap qualifier, each driver only has one shot at qualifying for this event, and the ten best times make the race. That puts a tremendous amount of pressure on a race team, because one mistake or minor mechanical problem can put them on the sidelines for the big show.

While your starting position in a 650-lap race isn't very important, the pole position always carries bragging rights. Dave Hechler earned the pole driving his TRC Pro 10, which was powered by a Trinity motor. Chris Smith started beside Hechler. Smith recorded the second fastest time with a Cam-powered TRC Pro 10, and Tim Lanier was third fastest with his BoLINK-powered BoLINK Enduro 10. Rounding out the second row was Bud Bartos, driving a BoLINK Eliminator 10 powered by a Cam motor.

NOVAK 650

Finish	Qual.	Driver	Chassis	Motor	Tires	ESC	Body
1	5	Chris Doseck	CompCraft	Trinity	TRC	Novak	BoLINK
2	10	Jimmy Simmons	TRC	Trinity	TRC	Novak	BoLINK
3	9	Rick Pruitt	McAllister	Revtech	KRP	Novak	McAllister
4	3	Tim Lanier	BoLINK	BoLINK	BoLINK	Novak	BoLINK
5	2	Chris Smith	TRC	CAM	TRC	Novak	Associated
6	8	Jim Fuller	CompCraft	Reedy	TRC	Novak	BoLINK
7	4	Bud Bartos	BoLINK	CAM	Delta	Novak	BoLINK
8	1	Dave Hechler	TRC	Trinity	TRC	Novak	BoLINK
9	6	Bob Williams	TRC	N/A	TRC	Novak	BoLINK
10	7	Rick Jordan	BoLINK	BoLINK	BoLINK	Novak	BoLINK

The Novak 650 usually takes about an hour and 15 minutes to complete, and a lot can happen in that time! Some drivers go out fast, trying to build up an early lead, while others may start out on tall tires, knowing the car will really make up time after the 400-lap mark.

Unfortunately, we didn't see much strategy at work. Chris Doseck moved up from the fifth starting position and was building up an early lead when it started to rain. The red flag came out and the field pulled onto pit road. It became obvious in the next few minutes that the race was over. Doseck had won the Novak 650 with only 224 laps completed. He drove a Trinity-powered Composite Craft Predator to victory. Jimmy Simmons finished 2nd, driving a Trinity-powered TRC Pro 10. Rick Pruitt took 3rd place with a Revtech-powered McAllister Outlaw. Tim Lanier was the only other driver who completed more than 200 laps before the rain hit, and he was driving the BoLINK-powered BoLINK Enduro.

This is the first time a Novak 650 didn't go the distance. While some may say Doseck's victory was tainted because it was shortened by the rain, how many other 1/10-scale electric R/C races would he have won with a 224-lap total? Most, right? Way to go, Chris! ■

Speedwork's Speedway motors were handed out to all stock amateur drivers, and these NARA-approved stock motors provide close competition. Kevin Lanier won the pole position driving a BoLINK LTO; he completed 36 laps at 37.97mph. Second fastest, at 37.96mph, was Toni Hartley, driving a CompositeCraft Predator. Jill Sims was third fastest, just missing out on a 36-lap run, driving her CompositeCraft car at an average 6.86 seconds per lap.

On Sunday, Lake Whippoorwill's Parade of Cars led off the opening festivities. Another first occurred when the lineup of cars circled the entire track, two abreast. Balloons and skydivers added to the excitement.

The McAllister Concours competition is always tough at Whippoorwill. In the true concours class, Mike Giesen won with a replica of Neil Bonnett's No. 21 Citgo T-Bird; George Smith took 2nd by copying Dale Earnhardt's No. 3 Chevy

Lumina; and Orville Coates captured 3rd with a Folgers Monte Carlo. In the best paint category, Akira Kogawa, from Japan, won 1st place with a Zest car (if Zest ever sponsors a NASCAR effort, they may want Kogawa to design the paint job); Mike Boylan captured 2nd place with a blue No. 07 Thunderbird; and Mark Harnish won 3rd place with the Solaroll car.

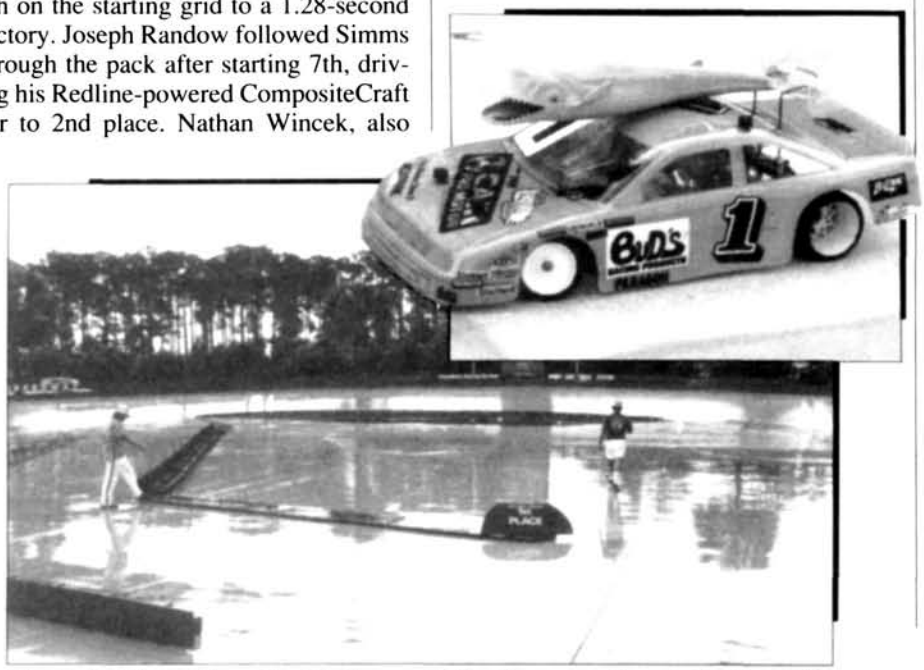
Once the photos were taken and the track was clear, it was time for the mains to get under way. With 32 mains to run, there was still a lot of racing ahead. The 1/10-scale Amateur Stock Class saw TQ Kevin Lanier win the A-Main driving his BoLINK car, winning by a lap over Matt Dahm. Dahm moved up from his 5th starting spot to finish with 35 laps, driving a TRC Pro 10. Tuffy Carrigg, also driving a TRC car, finished 3rd, just over 2 seconds behind Dahm.

The Amateur Modified race saw yet another first at Whippoorwill: Jill Simms became the first female driver to win a major A-Main event. Simms drove her Cam-powered CompositeCraft car from 6th on the starting grid to a 1.28-second victory. Joseph Randow followed Simms through the pack after starting 7th, driving his Redline-powered CompositeCraft car to 2nd place. Nathan Wincek, also using a Redline-powered CompositeCraft car, finished in 3rd place, on the same lap as the winner.

Kent Clausen backed up his 1/12-scale TQ spot with a 2.37-second victory over Shawn Ireland in the 1/12-scale A-Main. Both drivers drove Reedy-powered 12Ls. Chris Doseck brought his new CompositeCraft 1/12-scale, Trinity-powered car from 5th on the starting grid to 3rd place at the finish.

Clausen's luck ran out in the 1/10-scale Invitational A-Main when he dropped a cell at the start. Paul Davis pulled his Redline-powered CompositeCraft car into the lead, and the chase was on. At the 4:30 mark, Davis was still in the lead, but Cliff Lett was knocking on his rear bumper. Lett got by 2 seconds later, and he never had to look back. Lett won the 1/10-scale Invitational A-Main with his Reedy-powered 10L. Davis held on for 2nd place, followed by Chris Doseck driving a Lynx II with Trinity power.

The TRC/Trinity Challenge is in the record books. Neither the rain nor the AMB Autocount could stop the racing for long. In the end, there were many winners and lots of trophies handed out. But best of all, lots of new drivers had their first shot at superspeedway R/C racing. Make plans to get in on the excitement in Car Action's East versus West Shootout, being held at the Thunderdrome in California on Labor Day weekend, and the Third Annual Car Action Weekend, October 13, 14 and 15, at Lake Whippoorwill International Speedway. ■



Top photo: How wet was it at Whippoorwill? Bud's car caught a whale. Above: The track only looks like it has been freshly waxed. It actually had 6 inches of water standing in the infield near the scoreboard, but only 30 minutes after this photo was taken, they were back racing.

(Continued from page 72)

battery. To calculate current, divide voltage by resistance (amps = volts ÷ ohms): 6 volts ÷ .3 ohms = 20 amps. With this setup, the motor would be drawing 20 amps.

Eighty percent of all the design work I've done was based on these three formulas.

Watts

The watt is the unit of measure for power. Light bulbs, for example, are rated in watts. The larger the wattage rating, the brighter the light and the more electricity the light bulb will burn. The watts consumed by a device are computed by multiplying volts by amps (watts = volts x amps). Looking back at our water tank (Fig. 1) where volts represent the height of the water in the tank and amps represent the water running out of the hole, it makes sense that the larger the volume of water running out of the hole (amps) and the greater the pressure caused by high water in the tank (voltage), the faster the water wheel will turn. Simply put, it takes more power to make the water wheel or the motor in your car run fast.

Now let's put it all together for our cars. To understand why everything gets hot when you run large battery packs and hot motors, calculate the amount of power generated by a car battery when running hard and fast: 8.4 volts (7-cell pack) times 14 amps (not unusual for a hot car) equals 103.6 watts. Have you ever grabbed a burning 100-watt light bulb without getting burned? Admittedly, a lot of this power is converted to rotary motion by the motor, instead of being turned to heat. The power that's converted to rotary motion is the useful power, and the heat build-up is the wasted power. The ratio between the two is the efficiency of the system.

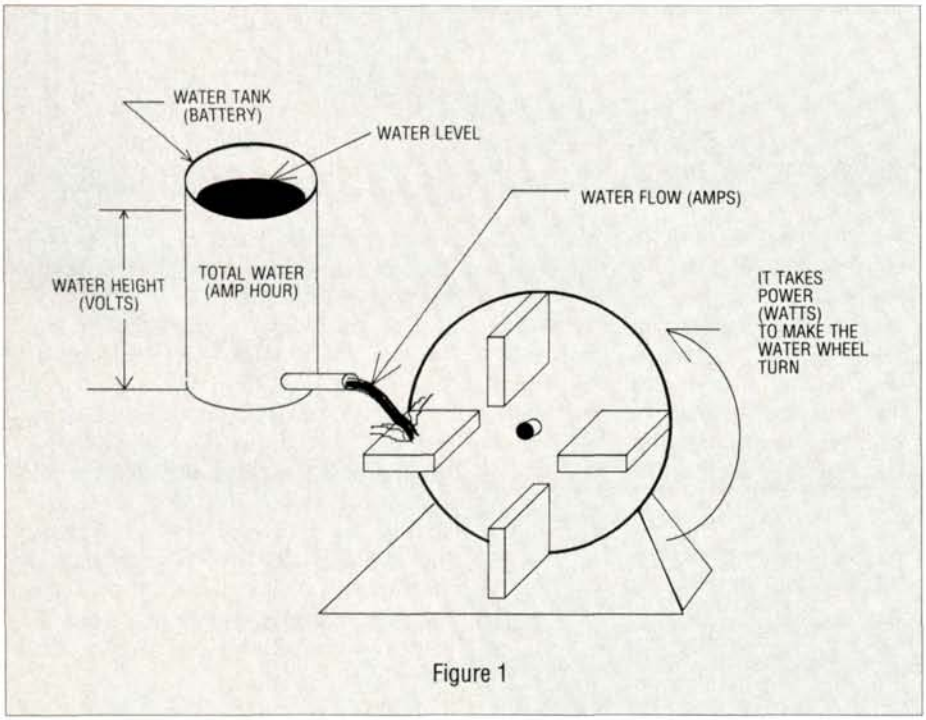


Figure 1

For example, if the battery is delivering 100 watts and the motor is converting 60 of these watts to rotary energy, that system is 60-percent efficient. You still have 40 watts of wasted power heating the battery, speed controller and motor. Motor manufacturers should give a horsepower rating and an efficiency rating at the motor's working rpm, instead of the meaningless no-load rpm rating that they do provide. Clarence Lee is a writer in the model airplane world who rates the horsepower and rpm, throttle response, etc., of model airplane motors. I would welcome some independent testing of model car motors to dispel manufacturer's wild claims.

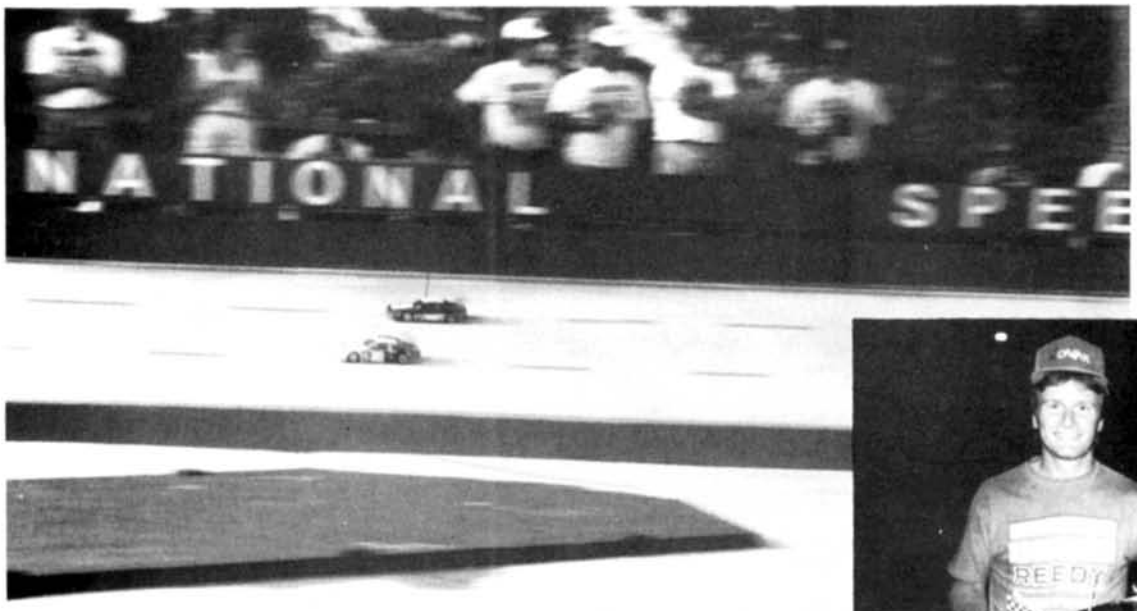
Amp-Hour Rating vs. Run Time

I promised you hammering hot-rodders some words of wisdom on amp-hour ratings versus run time. The amp-hour rating is the current (measured in amps) that it takes to discharge a battery in exactly 1 hour. A 1200mAh battery can supply 1200 milliamps of current for 1 hour.

(Continued on page 136)

POLE POSITION

by RICH HEMSTREET



Cliff Lett takes the lead in the Invitational Class of the Pole Position National Championship.

THE '89 NATIONAL CHAMPIONSHIP IS UNDERWAY

THE FIRST LEG of the 1989 Pole Position National Championship (PPNC) is complete! Nearly 300 racers took part in the TRC/Trinity Challenge. Look for the full race report elsewhere in this issue.

The PPNC is compiling the results from the four major 1/10-scale on-road oval races to come up with a true national champion in three separate classes: Invitational, Modified and Stock. The second race in the series is the ROAR Paved Oval Nationals, co-sponsored by *Car Action* (which will have taken place by the time you read this issue). The last two races comprise the Car Action East vs. West Shootout: the McAllister Racing/Dan's RC Stuff Thunderdrome on Labor Day weekend, and the Third Annual Car Action Weekend at Lake Whippoorwill International Speedway on October 13, 14 and 15 of this year.

I won't go into the complexities of the scoring system, except to say that the winner of each A-Main receives 200 points, the 2nd-place finisher earns 198 points and the TQ earns one bonus point. Racers who finish in 3rd, 4th and 5th places earn 196, 194 and 192 points, respectively. From 6th place in the A-Main on down through the rest of the mains, the point totals only drop by a single point. Basically, this system rewards both the top five finishers and the racers who show up for every race. The more races you compete in, the better you'll do.

For the drivers' championship, you can check the race results to determine the top 10 drivers after the first round. Don't forget to add one point to the top qualifier's total! Right now, Kevin Lanier is the only driver with a perfect score of 201 points for winning the Stock A-Main and Stock TQ title. As the PPNC season progresses, things should become pretty interesting.

The PPNC also includes a Chassis Manufacturers Championship (CMC), which combines all the A-Main results for the four races. (It may also include some lower main results at the ROAR Nats, because there isn't an invitational class.) In each A-Main, the highest finishing chassis from each manufacturer earns points, and the TQ chassis also earns a bonus point.

The current CMC standings are:

1. Composite Craft	25
2. BoLINK	19
3. TRC	16
4. Associated	11
5. Vicfor	5
6. McAllister	2

Before the series ends, I expect at least 10 manufacturers to earn points in the CMC.

While I wasn't planning on keeping track of the motor manufacturers in the same way, I did throw together a chart, using the same point system for the Invitational and Modified A-Main motors as I did for the CMC:

1. Redline	18
2. Cam	15
3. Trinity	12
4. Reedy	11
5. Quarterflash	8
6. Fantom	2
7. Twister	1

(Continued on page 84)

POLE POSITION

Kevin Lanier scored a perfect 201 points at the TRC/Trinity Challenge to lead the Stock Class PPNC.

As with the chassis manufacturers points, I expect these standings to change a great deal over the course of the series. I still don't have a motor championship, but let me know if you want me to report on one in the future.

Pit Stops or Sprints: Why Not Both?

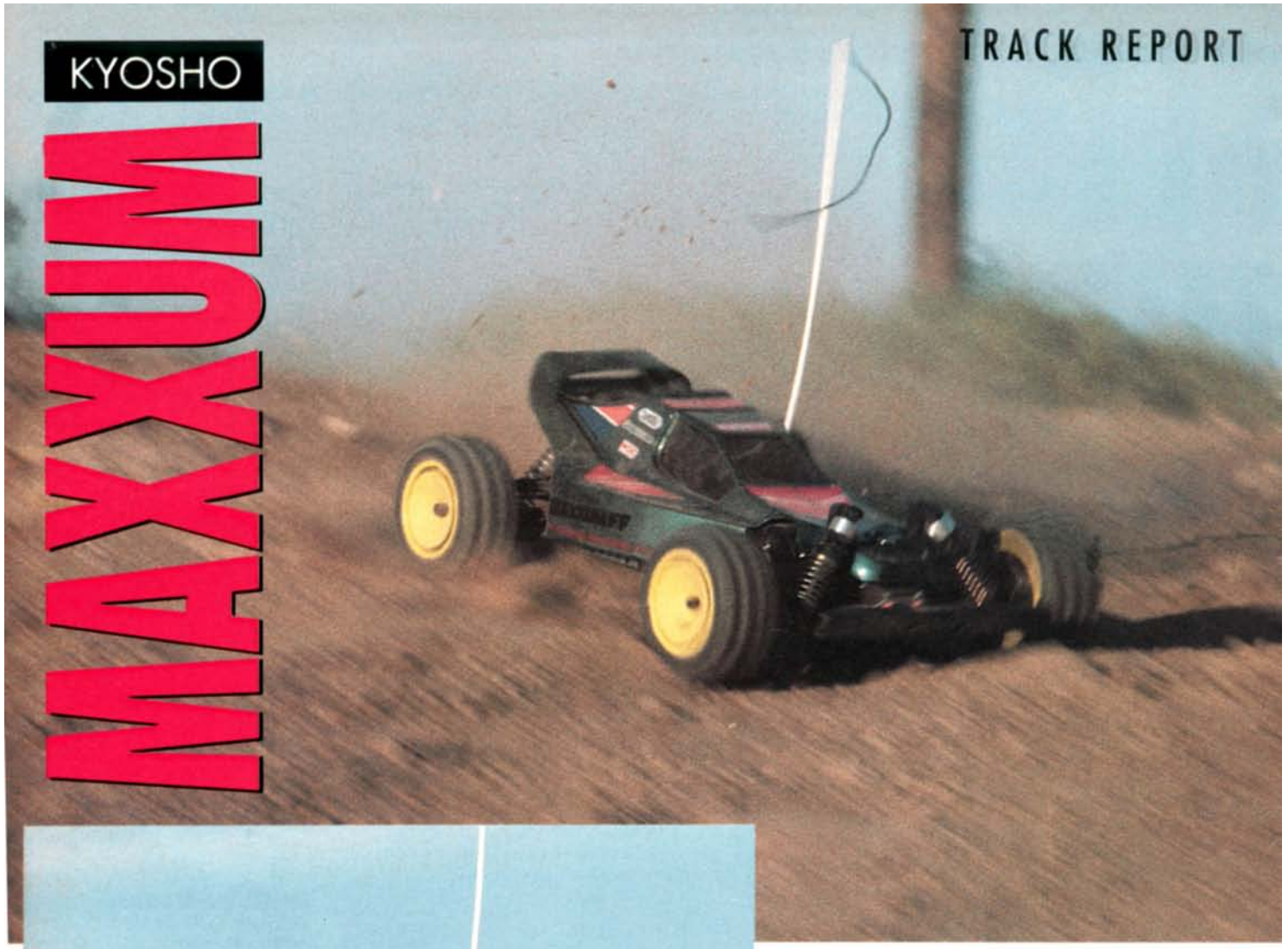
There seems to be some growing debate over 1/10-scale oval racing formats. While some want to stick to either the ROAR 6-cell, 4-minute format or the NARA 7-cell, 5-minute races, others are pushing for races of longer distances. These longer races require pit stops for battery changes, and this certainly brings more variables into the race. But the question is: Why? Why mess with the recognized formulas of timed racing events?

I don't claim to know all the answers, but it would seem awfully shortsighted to limit ourselves to any single format at this time—especially when you realize 1/10-scale on-road racing is really only three years old! Let's try to look further ahead and see where we are trying to go. Some R/C promoters hope to bring in outside sponsorship of events to create a truly professional race circuit. Others simply want their events to more closely resemble full-scale auto racing so that more new people will enter our sport. I think there should be room for both timed and distance events in the future of 1/10-scale on-road racing. Most of all, let's be sure to keep the fun in the sport.

That's it for this month; let's go racing! ■

KYOSHO

MAXXUM



FRONT-WHEEL DRIVE! Following in the footsteps of most major full-size auto manufacturers, Kyosho* has taken up the challenge of FWD. GM, Ford, Chrysler and a horde of Japanese auto makers have opted for FWD for two main reasons: It's easier to drive on slick surfaces, and it's cheaper to manufacture. In full-size cars, the second reason is the big one. Kyosho, however, seems to be trying to develop new technology in 1/10-scale racing.

THE KIT: Because the Kyosho Maxxum FF kit has a lot of parts, it takes a little time before the car is running around the track. FWD isn't uncomplicated, but Kyosho has paid attention to the manufacturing process so almost everything fits very well. As a matter of fact, the Maxxum car kit, with a few exceptions, is a fine example of how kit parts should fit together. There are, however, some mistakes in the instruction manual. I'm always puzzled by such errors, because it would seem so easy for the manufacturer to eliminate them by having a new kit built by a few people who are uninvolved in its

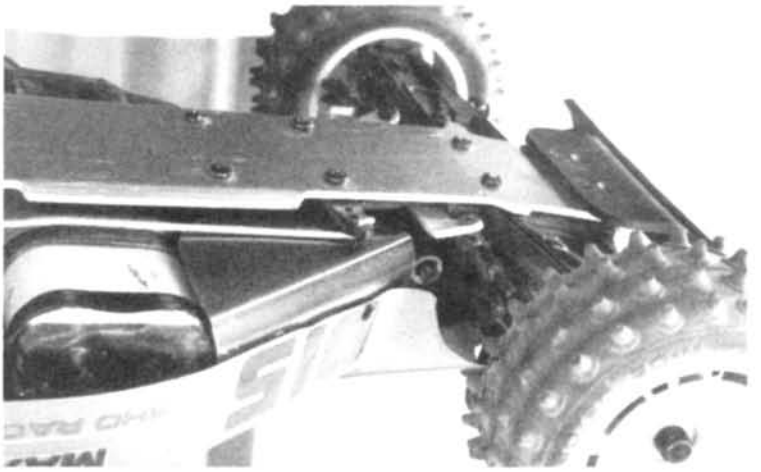
by DICK BRINTON

design and manufacture so that they could point out the errors in the instruction manual. It's rarely done that way, however, and the Maxxum is no exception.

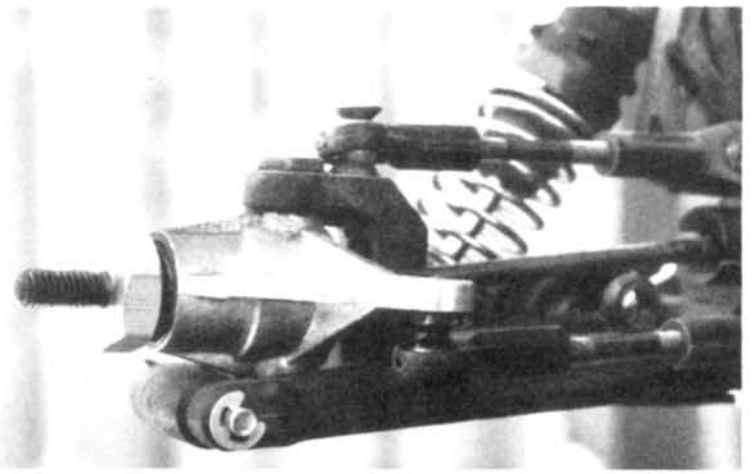
For instance, in the first assembly step, the shock piston is shown two ways: with one notch and with two. It's obvious the shocks on one end of the car should have one set of pistons and the other end requires the other set; unfortunately, there's no way to tell which goes where. Since the front end carries most of the weight, I decided to use the single-notch (more restrictive) set in the front and the double-notch set in the rear. After I have some run time on the car, I'll adjust with a different weight shock oil...which brings me to another complaint: The shock oil isn't labeled, so I don't know the weight of the oil that's in there now.

Other instruction glitches were:

- Step 3: In the kit I built, the long and the short control rods measured 38mm and 16mm (instead of 37mm and 15mm). These dimensions were required to get rid of the toe-out that resulted when I installed the rods using the lengths in the instructions. If Kyosho actually wanted toe-out, it should have been specified in the instructions. Since most cars require a bit of toe-in at the front and generally the rear wheels are parallel or have slight toe-in, any designed-in toe-out should be spelled out. Except for instructions for leveling the car, there are no recommended settings for the suspension. On a car as unusual as the FWD Maxxum FF, this is a big oversight.
- Step 4: Install the 2.6mm pivot ball as shown in the photo illustrating this article. Put the nut on the same side of the steering link that the ball is on and, using thread lock, jam the nut to lock the pivot ball. If the pivot ball is installed as directed, a lot of toe-out occurs when landing from a jump, and the car will suddenly veer to one side. By extending the pivot ball, this tendency is reduced but not eliminated. To solve this problem, Kyosho should supply a pivot ball with a longer shaft.
- Step 5: The screws for the servo mounts go in the center holes of the mount, not in the end holes, as the arrows seem to indicate.
- Step 11: The bevel-gear castings were rough and required reworking with a small file to get a smooth mesh. The differential isn't adjustable, so it becomes very loose after a little running time, and on full-throttle starts, some wild wheel spin can occur on one side or the other. I'm going to try the fix I used with the Raider: Sta-Lube disc-brake wheel-bearing grease in the differential. It's very thick and sticky, and the differential action is slowed quite a bit. So far, this grease hasn't damaged the Raider's gear case, but test it for yourself before you try it on your car.
- Step 12: Be careful with the screw cement: It can easily spread into the bushings or bearings if you use too much.
- Step 17: This is the only example of poor fit in this kit. The Kyosho bearings I used fit loosely in the front knuckles, and this allowed the wheels to wobble more than 2mm. A new set of front knuckles with bearings showed up from Great Planes. The new parts fit together much better and reduced the slop somewhat. I also had to remove material from both front hubs (part No. 63) to achieve sufficient clearance to allow the front knuckles to turn freely in the hubs.
- Step 18: The M 4x8 setscrew adjustment is shown on page 23,



The motor shield is an absolute necessity on this car, since there's no room for a sponge filter.



To remove some of the toe-out that develops under compression of the front springs, installation of the pivot ball differed from what the instructions suggested.

FROM THE FRONT

not page 19.

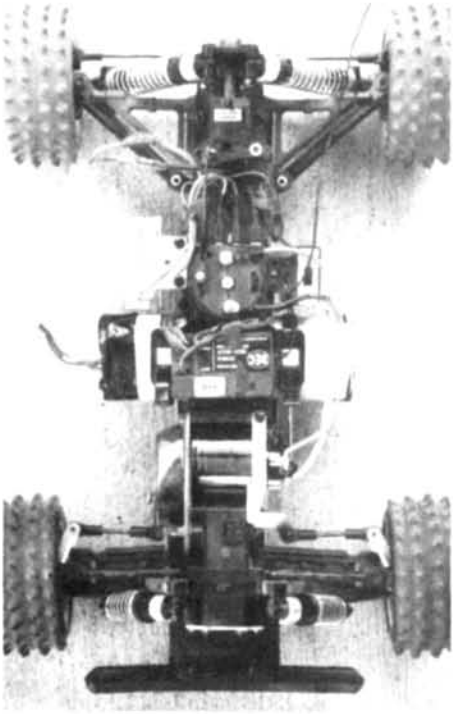
• Step 33: There are two screw spacers required—not just one. I used a flat washer on screw M 2.6x12 to prevent the speed control arm from coming off the servo. On the connection for the speed controller, the arrow points to the center hole, but the directions say to use the outside hole. I used the center hole, and it worked fine.

The photo Kyosho supplies showing the completed kit without the body isn't accurate; apparently, it's of a pre-production model. I assembled the car according to the instructions, except for routing the speed controller wires away from the servo arm by using Associated's* motor connector set. On page 22, there's a nice section on the care and maintenance of the new Kyosho rotary speed controller. I had no trouble with this at all; in fact, it's one of the best stock speed controllers I've seen.

There are also directions for cutting the lugs on the tires to accommodate different track surfaces—nice touch.

The kit provided a 15-tooth pinion gear,

(Continued on page 142)



Top view of the completed chassis showing the unique layout. Note that the battery pack is centrally located.

KYOSHO

MAXXUM FF

Type	FWD off-road
Scale	1/10
Sug. Retail Price	$249.95

DIMENSIONS:

Overall Length	14.5 inches
Width	9.4 inches
Height	5.0 inches
Wheelbase	10.25 inches
Front Track	7.9 inches
Rear Track	7.9 inches

WEIGHT:

Gross (w/bat.)	3.5 pounds

BODY:

Type	Single-seat
Material	Polycarbonate

CHASSIS:

Type	Twin flat plate
Material	Aluminum alloy, lower; FRP, upper

DRIVE TRAIN:

Type	Pinion/spur
Differential	Planetary gear
Bearings/bushings	Metal bushings

SUSPENSION:

Type (f/r)	Parallel arms
Dampening (f/r)	Adjustable oil shocks

WHEELS:

Type (f/r)	One-piece, low-profile
Dimensions (DxW) (f/r)	2x1.25 inches

TIRES:

Front/Rear	Full spikes

ELECTRICS:

Motor	LeMans 240 ST
Battery Req'd.	7.2V
Speed Controller	Kyosho rotary w/reverse, no braking

OPTIONS AS TESTED:

JR Propo beat2 Alpina radio, Kyosho ball bearings

COMMENTS:

The Maxxum FF works well on a tacky track, but because of its loose, non-adjustable differential, its performance in sand or on slippery tracks isn't very good. The kit is of good quality and, with the exception of the front bearings, the parts fit is excellent.

JR'S beat2 ALPINA

PISTOL-GRIP RADIO

IN MY MAXXUM FF, I used the JR Propo beat2 Alpina. Don't be put off by its rather strange name: This is a very good radio.

It transmits and receives on the 27MHz band, and the receiver is a 10kHz narrow-band AM receiver that seems to be less susceptible to interference than others I've seen.

The beat2 Alpina comes with a Battery Eliminator Circuit (BEC), features throttle and steering trim, servo reversing and throttle and steering end-point adjustments. In addition, there's a steering-rate adjustment (that I'd call dial-a-track) and even a steering wheel tension adjustment, so you can tailor the feel to your individual requirements.

It comes set up for regular batteries in the transmitter, but it has a built-in charging jack, so it can be converted to use rechargeable cells.

The range is very good and the connection between transmitter and receiver is strong. In my testing so far, there's been no sign of glitching.

DIRT DIGEST

by BOB KANE & BILL O'BRIEN

Cornering science

DESPITE ALL MY carping and stern refusals, I actually picked up an RC10 last weekend. It was a busy two days that found me also adding a Top Cat and a Yokomo YZ-10 to my R/C garage. (Bob and I both ordered RC 500s, but they have yet to arrive—it was an odd weekend.) But it was the RC10 that held most of my interest, and I wanted to see just what a good setup was before I built the car.

With that in mind, Bob and I headed out to Long Island for the opening day of the Small Torque Club, which holds races in Depot Road Park in Huntington Station. Without a doubt, that track is RC10 country. The two or three Ultimas and JR-X2s were vastly outnumbered by a sea of gold-anodized aluminum chassis. At this track, the 2WD Main is a stock-class event, and it begins roughly in the middle of an 85-foot straight that leads into the first 90-degree curve of the oval. Two-thirds of the field wiped out in that corner, right off the line.

Granted, the biggest problem is the over-enthusiastic drivers who don't let off the throttle as they enter the turn, but all through the 4-minute race, we watched cars run high in the corners when they should have *entered* high and *exited* low—and these are RC10s with front stabilizer bars! (Half the world calls them anti-roll bars, the other half calls them anti-sway bars, so I'll take the coward's way out with the third half of the world and just call them stabilizer bars.) Why this happens seemed to be something to write about, and, since Bob is in Seattle watching a ball game, I didn't have to discuss it with him.

Turn Dynamics

Two forces that affect your car whenever you run through a turn are gravity and centrifugal force. Gravity, of course, is a line of force reaching up from the center of the earth that holds your car on the ground. Centrifugal force is the constant force that acts away from the center of the turn. These two forces reach their worst difference of opinion in a turn.

When you take a turn with your car, you're really executing a series of straight-line movements that form tangents to the arc of the turn (Fig. 1). This is because your car is a rigid vehicle that

Figure 1

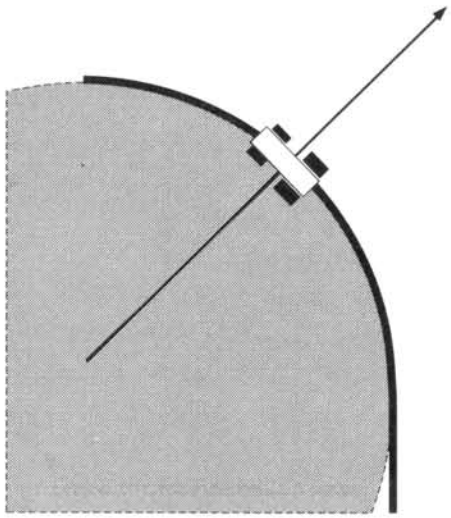


Figure 2

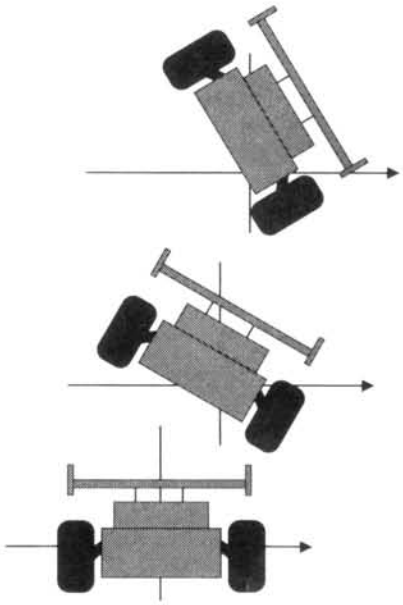


Figure 3

Figure 1
A curve is a series of intersecting tangents. Your car follows the route of those tangents whenever you throw it into a turn. The differential allows the inside rear wheel to rotate at a different rate than the outside wheel, and this prevents the car from skidding.

Figure 2
Taking a turn is as simple as asking gravity to hold your car down while centrifugal force attempts to flip it off the track. Spring rates, stabilizer settings, wheel track and center of gravity are all variables that decide whether or not centrifugal force will win.

Figure 3
At a normal attitude, the center of gravity and the center line of the car are in line with each other, (unless you're running an offset chassis for oval racing). Even if you're riding a bicycle, you'll be safe as long as the center of gravity remains on the side of the center line opposite that of the direction of centrifugal force. However, at the top, you'll see that the center of gravity has passed the point of no return. Your car will soon be riding on its roof.

(you hope) doesn't bend in the middle, and what you're really doing is moving through a series of controlled skids. Your differential tends to minimize the slippage of the rear wheels by allowing the inside wheel to turn less than the outside wheel, but the tangential movement of the car is undeniable.

In that turn, centrifugal force makes a beeline from what would be the center of the turn to the outside wall (Fig. 2). Depending on the center of gravity (CG) of the vehicle and whether it understeers or oversteers, the effect will be visible if you watch the inside wheels. In mild cases, either the inside front or inside rear wheel will lift slightly off the ground. (You can see excellent examples of this in USAC Sprint or TQ races.) In extreme cases, the wheel lifts high enough to move the car's CG beyond the center line of the car, and that's when centrifugal force overcomes gravity and sends your car cartwheeling off the edge of the track (Fig. 3).

Suspension Dynamics

The best way to avoid the situation is to ease off the throttle as you enter a turn. Since you don't want to drift through it at some annoyingly low speed, you can start throttling up as you enter the apex of the turn and plan for full throttle again as you leave the apex (Fig. 4).

Of course, we all want to go as fast as possible—even when slowing down—and there are a few ways to cheat the laws of physics by applying them to the suspension of your car. The RC10 has some great suspension dynamics to play with. For example, take a look at the front stabilizer bar.

A stabilizer bar is secured to the RC10 at two chassis points and two suspension points (Fig. 5). As the RC10 enters a turn, the inside rear edge of the chassis starts to rise (typical of oversteering cars). This causes the outside front edge of the chassis to dip, raising the outside front wheel (relative to the height of the chassis).

As the wheel and chassis become disoriented, the action twists the stabilizer bar, forcing the inside front wheel down (again, relative to the movement of the chassis, which is rising on the inside). Because the A-arms are connected to the chassis, eventually, through a kinetic chain of command across the stabilizer bar, that opposing force is applied to the chassis as well as the wheels. The heavier the stabilizer bar is, the more downforce that inside front wheel will receive to keep the car on the ground. You can add or subtract some degree of stiffness by adjusting the mounting (pivot) points up or down the bar.

Stabilizers, however, can only do so much. You'll also need to deal with the kinetics (a great word that means the way things move) of the springs on your shock absorbers.

As the inside rear section of the chassis lifts, the left rear spring expands from the tug of gravity on the wheel. At the same time, the right front spring is being compressed as the chassis drops. The amount of compression in that spring is very important. If it's a light spring and it starts out fully extended on the shock, the left rear side of the chassis will go through a rapid rise as the front right spring approaches the maximum point of compression. Of course, as it nears that maximum compression point, the rate at which the

(Continued on page 144)

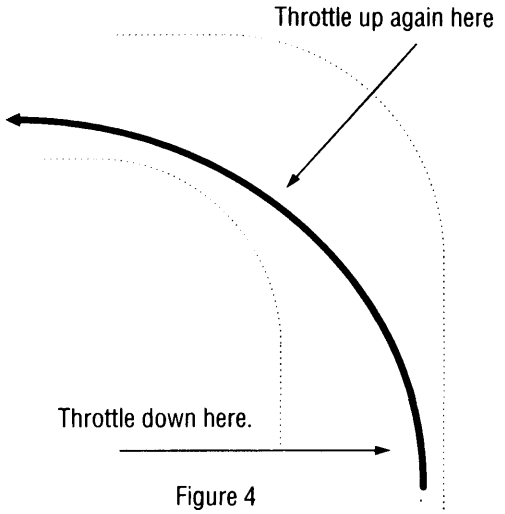


Figure 4

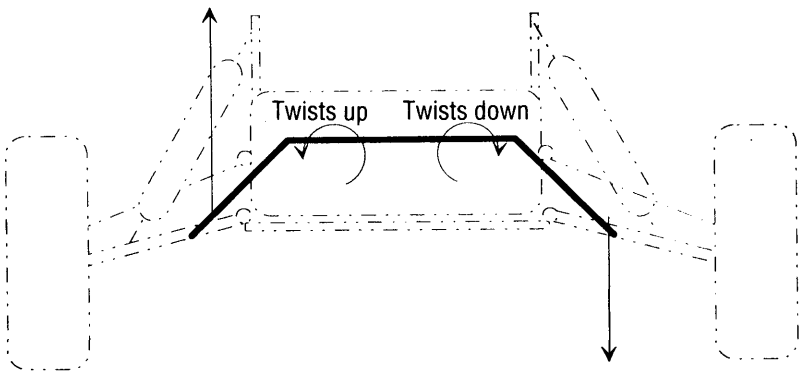


Figure 5

Figure 4
Turn dynamics dictate that you enter a turn high while easing off the throttle, then dive low and power up again as you reach the apex of the turn. Not only does this provide you with the quickest and straightest path through the turns, but it can also save you from ending top-side-down in a corner marshal's hands.

Figure 5
Stabilizer rods use torsional strength (the resistance to twisting along the length of the rod) to keep the wheels on the ground. You can fine-tune a bar by adjusting the A-arm and frame contact points. Changing rod diameters will also work.

By being aware of how tire diameter will affect your overall gear ratio, you'll be leading the pack to the checkered flag.

TIRE TRUING

PART II

How to use your tires to your advantage

by JOE BRUNI

IN PART I of this series, I explained how to properly mount and true foam tires for use on 1/10 and 1/12-scale on-road cars, or for just about any other application that requires a foam tire. This month, I'll explain how tire size that's determined either by wear or as a result of truing will impact the performance of your car. No matter how serious you are about oval or road racing, proper gearing will play an important part in improving your car's performance.

Gear ratios can be altered with a pinion change, a spur-gear change, and a change in tire diameter. At local tracks, I've witnessed many racers dumping their batteries early, because they've replaced their worn tires with a new set. Although the old set of tires started out the same as the new pair, chances are that the new set will be approximately 3/8 inch larger in diameter. If the car was geared to run with these extremely worn tires, putting on the new set would be the equivalent of going up 2 teeth on a 32-pitch pinion gear. As you can see on the chart, if your worn tire is 2.18 inches in diameter and you're running a 3.43:1 gear ratio with a 14-tooth pinion and a 48-tooth spur gear, the distance traveled (roll-out) would be 2 inches per motor rpm. If you change to a 2.5-inch-diameter tire and maintain the same gear ratio, the roll-out would be 2.29 inches per motor rpm. In the lower right corner of the chart you can see that this is virtually the same distance (2.28 inches/rpm) you would have achieved by changing to a 16-tooth pinion and keeping the worn tires. As most racers know, a 2-tooth change in pinion size will have a drastic effect on run time.

Calculated truing can give you that winning edge. You can determine your present gear ratio by simply counting the number of teeth on your spur gear (S) and dividing it by the number of teeth on your pinion gear (P). By simply varying the diameter of the rear tire, you can dramatically change a car's performance. Here's an example of how this formula works: If you're using a 13-tooth pinion and a 54-tooth spur gear, your gear ratio is 54 ÷ 13 = 4.15. Now measure the diameter of your rear tire (for example, 2.5 inches) and

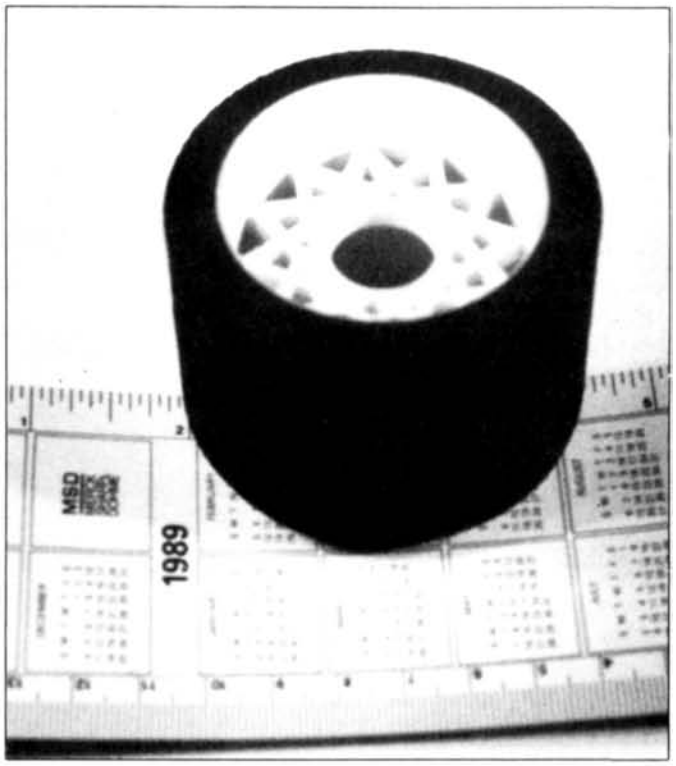
32 Pitch Gears			Distance traveled, in inches, per motor revolution by tire diameter (inches)								
Spur	Pinion	Ratio	2.50	2.47	2.43	2.40	2.37	2.34	2.31	2.25	2.18
48	10	4.80	1.64	1.62	1.60	1.57	1.55	1.53	1.52	1.47	1.43
48	11	4.36	1.80	1.78	1.76	1.73	1.71	1.68	1.67	1.62	1.57
48	12	4.00	1.96	1.94	1.92	1.89	1.86	1.84	1.82	1.77	1.71
48	13	3.69	2.13	2.10	2.08	2.04	2.02	1.99	1.97	1.91	1.85
48	14	3.43	2.29	2.26	2.24	2.20	2.17	2.14	2.13	2.06	2.00
48	15	3.20	2.45	2.42	2.40	2.36	2.33	2.30	2.28	2.21	2.14
48	16	3.00	2.62	2.59	2.56	2.51	2.48	2.45	2.43	2.36	2.28

TIRE TRUING

multiply it times the fixed number 3.14 (or pi, the ratio of the circumference of the tire to its diameter). The circumference of the tire is 7.85 inches. Now divide 7.85 inches by the gear ratio to determine how far your car will travel per motor revolution. A tire with a circumference of 7.85 inches driven by a gear ratio of 4.15:1 will allow the car to travel 1.89 inches per motor revolution (7.85 ÷ 4.15).

Now, let's change the tire to a smaller diameter tire of 2.25 inches. Plug it into the formula and you should get (2.25 x 3.14) ÷ 4.15 = 1.70. So if you replaced your original tires with a slightly smaller diameter tire, your car will now go 1.70 inches every rpm, or .19 inches less distance per rpm than with the taller tire. This may seem insignificant, but don't forget your average stock motor winds out at approximately 22,000rpm. Therefore, that .19 inches makes a big difference—almost 350 feet per minute! The most difficult part of gear-to-tire ratios is applying these calculations to your particular track condition. To find the best set-up for your car and track, you'll have to use these calculations, keep records and *practice*.

Pro Proven Products* Tire Truing Machine can be used not only for repairing damaged or improperly worn tires, but also for fine-tuning your car's performance. It's also possible to determine how much change in gearing will be required as your tires wear. To maintain maximum speed while you're running 4 minutes on the button with a fresh set of tires, you'll eventually have to go to a larger pinion as the tires wear. The inverse is also true. If you're just getting 4 minutes out of your car with a set of worn tires, you'll have to switch to a smaller pinion when you put on a new set of tires. The theory here also applies to other forms of R/C racing, including 1/10-scale off-road cars. Although most off-road cars run rubber tires that are less likely to wear, even a small difference in tire size can make a big difference in performance. If you're changing to a different type of tire, it's even more critical to determine if there's any major difference in diameter and to adjust your gear ratio accordingly. With off-road tires, it's not uncommon to see a notable difference in tire diameter from brand to brand.



The size of your tires greatly impacts your car's overall performance.

Just as tire compounds and tread patterns alter the handling characteristics of your car, variation in tire diameter will drastically affect the acceleration and duration characteristics. The next time you put on a set of those hot new tires and you dump at 3 minutes or chop 5mph off your top speed, break out the ruler and plug your findings into the equation above. The results may surprise you!

**Here's the address of the company mentioned in this article:*
***Pro Proven Products,** P.O. Box 15201, Palma Sola Station, Bradenton, FL 34280-5201.* ■

AERO-STREAK

(Continued from page 23)

Gold or Platinum Kyosho shocks for better handling; and the universal swing-shaft system that virtually eliminates binding or lost dogbones.

PERFORMANCE: After about only 30 minutes of installing the radio and adding detailing, the Aero-Streak was at the starting line, ready to show us its stuff. Acceleration off the line was impressive, with very little loss of traction. (Keep in mind that this was with out-of-the-box factory settings.) Going through the turns, the steering response wasn't as effective as I'd have liked, but remember that no changes had been made to the stock Streak. The Aero-Streak handled the off-road terrain with very good stability, and ample power was provided by the stock motor. After the first run, I went back to the pits for a once-over.

First, I checked the front suspension. Its travel seemed limited by the shock position, and a closer look revealed that there were two mounting positions for the shocks. The factory setting had the shocks mounted on the *outside* position (the position closest to the wheel). Using the *inside* hole for shock mounting greatly increased the movement of the front A-arm. The overall tension on the front A-arms was decreased, and this allowed a much more effective steering response. Moving the shock position and freeing-up the A-arm movement served the same purpose as placing a lighter oil and/or spring on the front shocks. After this adjustment, the Aero-Streak was back in action with a remarkably improved handling and steering response. The Aero-Streak performs with a confidence that I have yet to see in any other ready-to-run 4WD buggy.

If you're a new R/C fan looking for a first car and you want to avoid all those assembly nightmares, the Kyosho Aero-Streak is a must-see. While it won't be a threat at this year's World Championships, it will certainly be a good performer at the local level. And, best of all, it won't break the bank if you're not sure that four-wheel off-roading is for you.

**Here's the address of the company featured in this article:*
Kyosho; *distributed by Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.*■

SCOPING OUT

(Continued from page 30)

cent .01-ohm resistor. By measuring the voltage drop across this resistor, the current meter reading can be double-checked. Of course, the 6-volt lab supply provides the test voltage.

Following the diagram on the instruction sheet, I plugged the speed controller into the test setup. The instruction sheet is quite good, though some of its wording is a little confusing—probably because it was translated from Japanese. It took me a second to realize that "the running Ni-Cd battery" simply meant the battery pack. I did find one mistake (I think) in the section on adjusting the neutral pot. If you read carefully, however, all of the necessary instructions are there. The next confusing statement said: "The power switch has been removed for safety. The running Ni-Cd battery connector serves as the power switch. Forgetting to turn off the switch is prevented by disconnecting the connector." I don't call it "safe" to plug a hot battery into a car and have the car run up your arm because someone has played with your throttle trim on your transmitter. Personally, I like an on-off switch so I can hold the car with one hand

and turn the switch on with the other. Since plugging the battery in is a two-handed task, you don't have a free hand to hold the car.

On with the testing! The first step is to get all the trim pots set for proper operation. Before you start, I recommend that you set the throttle trim on your transmitter to its midpoint and that the servo travel limits be set to maximum travel as described in your transmitter handbook. Not all transmitters have servo travel adjustments; check your transmitter handbook for details. The instruction sheet recommends that you do not have a motor attached for the initial setup, and I agree that this is a good policy. With the throttle set at neutral, I adjusted the neutral trimmer. This is the part of the instruction sheet that I think has an error. It says: "A point a little before the point at which the lamp goes off is the neutral point." I think this means leave the lamp on, but in truth the neutral is the point at which the lamp just turns off. The neutral point can also be fine-tuned with the throttle trim when you are out running the car (i.e., if the car won't sit still when you plug in the battery, adjust the throttle trim for neutral).

The next setting is the "high point trimmer," which is the full-speed adjustment. To set this pot, advance the throttle to the 80-percent point and adjust the pot until the adjustment lamp turns from green to red. The last setting is the "reverse point trimmer." I read this step several times in the instruction sheet, and I'm still not sure what they're trying to say. From experimentation and watching the output of the speed controller on the oscilloscope, I determined that what the reverse pot does is set the reverse delay. If you set the pot full clockwise, you get good linear braking action and about a 1/2- to 1-second delay before the reverse kicks in. I like to run my car in this mode, because it gives me better control over the brakes and the delay yields a softer reverse, which is nice for lessening the stress on the gear train. If you turn the pot full counterclockwise, the reverse delay goes to zero and the car slams instantly between forward and reverse.

With all the trimmers now adjusted, I plugged the MC111B into the power supply and placed the load resistors across the output. The load was adjusted to create 12 amps of current to flow, and the input-versus-output voltage measurements revealed a voltage loss of .33V. Dividing volts by amps gives resistance, so this means that the total resistance of this speed controller is .0275 ohms. Now this is considerably more than the .016 ohms stated on the instruction sheet, but you must remember that all of the manufacturers are competing for sales and like to quote as low a number as possible. For this reason and reasons of standardization, they quote only the resistance of the FETs that act as the electronic switch. When I measure a speed controller that has factory-installed battery connectors and motor connectors, I take the readings right on the connector that are supplied with the controller. My readings yield the true connector-to-connector loss of the speed controller in the configuration supplied by the manufacturer. Another point worth stressing is that if you're serious enough about the R/C car hobby to buy an electronic speed controller, you should be serious enough to throw away the factory connectors and replace them with either gold- or silver-plated connectors. Just watch the polarity, because a reversed connector will destroy your controller.

The last part of the lab test involves taking the speed controller apart. This inspection revealed that the MC111B has a total of 12 FETs, a glass epoxy PC board, some surface-mount parts, good-

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SCOPING OUT

(Continued from page 101)

looking solder joints, and that the heavier parts are "ruggedized" in place with a potting compound. The FETs were of the insulated tab-type, which explains how Futaba can get away with one metal heatsink attached to all 12 of the FETs without causing a burnout. All in all, this is a very well-made unit.

And now the nasty test! I let the controller cook at 12 amps for 15 minutes. It did get quite warm, but it didn't suffer any damage. (It should run a lot colder in your car if you mount it so that air flows over the heat sink.) I then jammed my screwdriver across the output terminals to simulate a jammed motor. The sparks flew, but the speed controller survived. I don't wish to imply that the MC111B is burnout-proof, but it's rugged enough to survive a gear jam or a motor lock-up, if you don't insist on holding the throttle down until the smoke comes out.

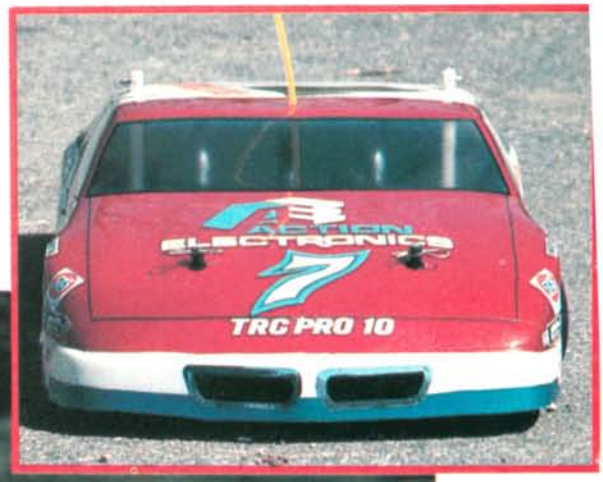
Now for the fun (and last) phase of testing a speed controller. I mounted the controller into my Turbo Ultima, rechecked the three trimmer settings and headed for the track. The speed controller has a good solid feel. The forward throttle response was smooth, and there was no surging at slower speeds. As I mentioned before, the reverse trimmer will adjust the reverse action all the way from soft and easy to violent. One experiment that I tried with reverse was to find a transmitter trim endpoint setting/speed-controller reverse trim setting that would dial-out reverse. For safety reasons, some race tracks don't permit reverse. I couldn't find a combination that would kill reverse on the MC111B. A feature manufacturers should consider for FET controllers is a slide switch on the side that could turn off reverse and, at the same time, reduce the resistance of the speed controller for racing.

What I liked about the MC111B is its solid construction, its reasonably low-loss 12 FET setup and its adjustable delay

(Continued on page 106)

Short-Track Sponsor Decals

Make your own decals of local heroes' cars



by BOB GAGNE

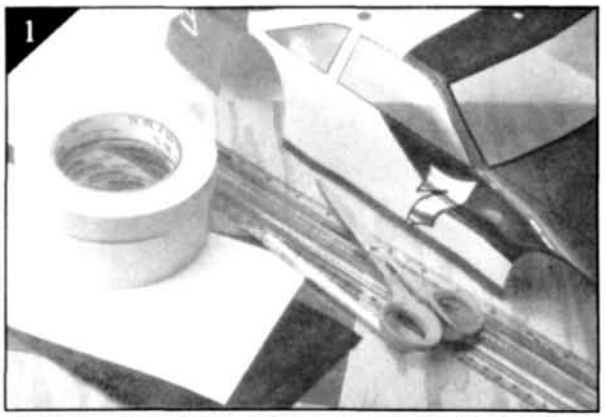
WITH A LITTLE patience and some searching through the decal racks at the local hobby shop, just about anyone can detail a NASCAR-type stock-car body to reproduce his or her favorite Winston Cup contender. Nearly all the "big-time" sponsors' logos are produced commercially by several companies. However, modelers who want to produce a replica of their favorite ASA or local short-track cars are often out of luck when they look for decals of the sponsors of these lesser-known racers. Take heart: Now you can create these impossible-to-find graphics!

The first step of a car-detailing project is planning. Decide on the graphics you'll have to create to accurately copy your favorite racer. Color photos of the car from the front, back and side are ideal for planning the layout and colors of the graphics on your own model. You'll also need a reproduction of the artwork for each of the graphics. Many of these cars are sponsored by local businesses that have their own logos painted on the car. These businesses might supply you with a copy of their artwork, or you might be able to get a photocopy from a printed ad. Even a business card could be used. Sponsors often run ads in the race program, so don't overlook this source.

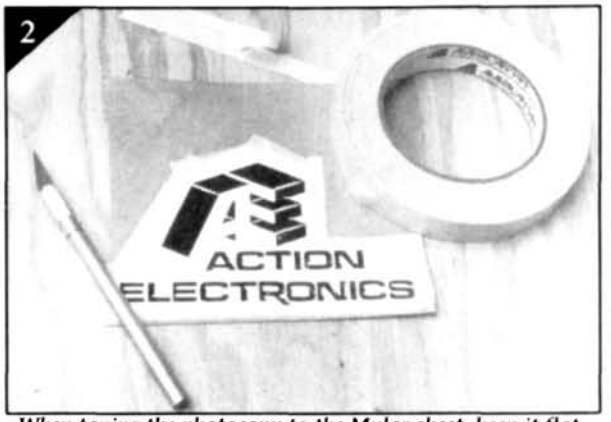
After you have the artwork, decide on the size you need. Try a freehand drawing on a piece of clear plastic or even a plain sheet of paper, and compare it to the body that you're working on and to the photos of the real car. When you've found the size that looks right, have photocopy enlargements or reductions made of the original artwork to that size (photocopies can be made at a local print shop or at a business that offers that service.) Be sure that you make enough copies: You need at least one for each time that the logo appears on the car, but you might need additional copies if there are different colors in the design. For example, if the logo appears three times on the car (both doors and the hood), you'll need three copies. However, if the logo is red and blue, you may need six copies (the number of times the logo appears times the number of colors in the design).

With enough photocopies on hand, you're ready to create the decals for your own model. Before you start, collect the following materials:

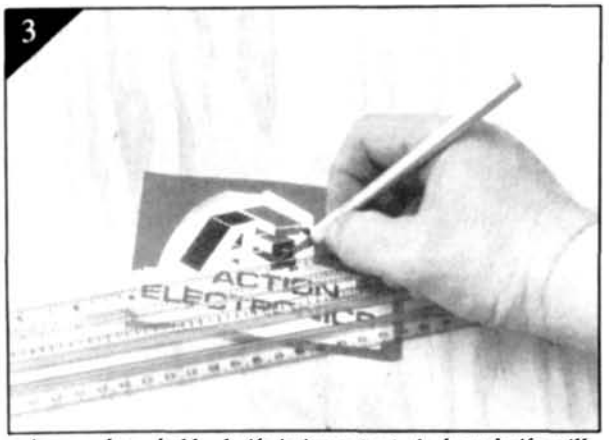
- Mylar sheets in the colors closest



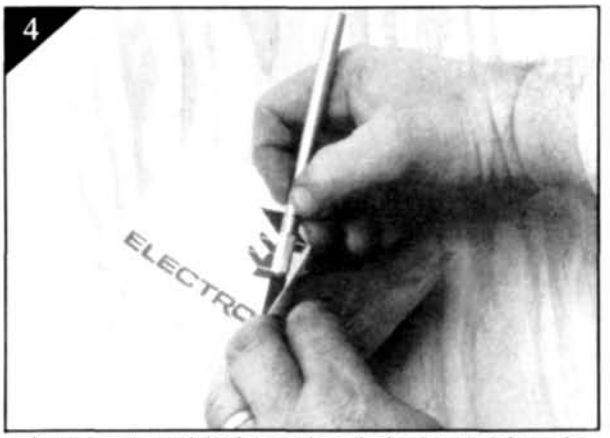
Gather your materials before you start the project. They should include: Mylar decal sheets, a hobby knife, masking tape, scissors, a straightedge and a body.



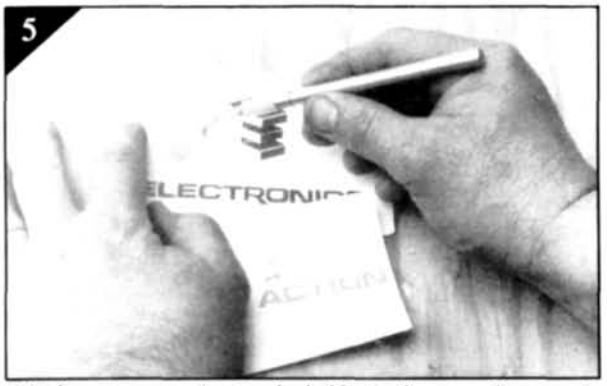
When taping the photocopy to the Mylar sheet, keep it flat against the sheet and as tight as possible.



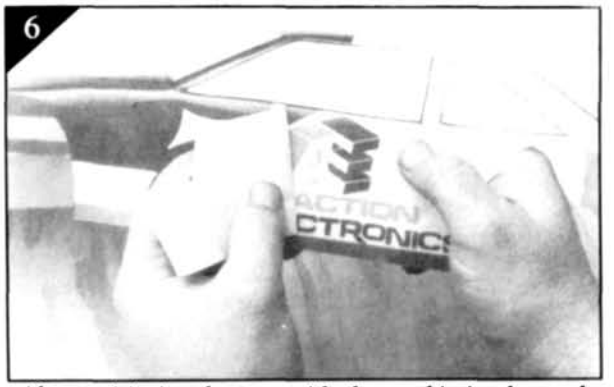
A very sharp hobby knife is important. A sharp knife will cut through the paper and the Mylar film more easily. The less force you apply when cutting, the cleaner the design. Try not to cut through the backing paper.



If you aren't careful when peeling the background from the basic design, you may tear the design, or lift part of the design with the background. Use the tip of the knife to hold the edges of stubborn letters.



With tweezers or the tip of a hobby knife, move the second part of the design to the backing paper of the basic design. You can move the parts around on the backing paper until they look right. They'll slide a little if you don't press them too hard against the backing paper when you place them.



After positioning the tape with the graphic in place, rub through the tape to stick the design to the body. Peel the tape back slowly, and watch for letters that didn't stick well enough.

to those in your design (e.g., Top Flite's* Trim MonoKote or Coverite's* Black Baron Presto)
- a very sharp hobby knife
- a straightedge
- wide masking tape (1 1/2 inches or wider)
- tweezers
- scissors
- a fitted and painted body

If you have a particularly intricate design, you may need a sheet of silicone release paper to help you position the different parts of the

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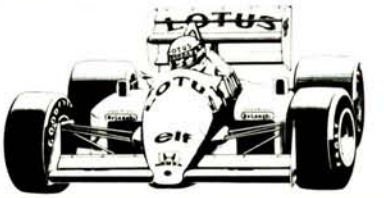
SCOPING OUT

(Continued from page 102)

reverse, which permitted settings all the way from a car-saving 1/2-second delay to an instantaneous response. What I didn't like was some of the wording on the instruction sheet. Although the odd wording can be humorous, I'm afraid that a newcomer to the hobby might find the instructions confusing. The MC111B definitely is a useable reversing speed controller, and it will be a big improvement over your mechanical speed controller. Have fun, but watch out for mud puddles—water is bad for your FET speed controller.

Here is the address of the company mentioned in this article:

***Futaba Corporation of America,** 4 Studebaker, Irvine, CA 92718.* ■



Track Report

Kyosho

ULTIMA

from Great Planes

SECOND LOOK SERIES

The race for 2WD supremacy is grueling—Kyosho claims this is the next victor!

by RICH HEMSTREET

GREAT PLANES Model Distributors* boldly claim the Kyosho Ultima will be the next two-wheel-drive off-road world champion. After the success of the four-wheel-drive Optima, the competition should look out. Kyosho has spent a year developing the new Ultima. The Ultima is ready to challenge the world.

THE KIT. The Ultima comes in a colorful package. The illustrated 24-page instruction book is easy to follow. The last two pages of the instructions are very helpful; they show full-size drawings of the small parts required for each step. An aluminum chassis is the backbone of the Ultima.

The car is complete except for a radio, batteries and a charger. I used the new Pulsar Pro 2000 radio system and the Hobbico 12-volt multicharger, both available from Great Planes.

CONSTRUCTION. With just simple hand tools, the Ultima goes together easily. The instructions are broken down into 43 concise steps. The gearbox and rear suspension are built in steps one through eleven. In steps 12 to 16, you complete the front suspension. The front and rear suspensions are largely built of EX-66 nylon for strength and light weight. Lower A-arms and upper control rods provide for plenty of suspension travel. Each corner of the suspension has an oil-filled coil-over shock absorber.

This is all Kyosho expects the competition to see of the Ultima.

The front suspension has an anti-roll bar as standard equipment. The instructions give some handling advice about when to use the anti-roll bar and when to take it off.

The Pulsar K-88 servos bolt right into place. These servos would be too large for most 1/12-scale cars, but they're perfect for 1/10-scale cars. The servos are quick and give positive control responses. The receiver is light and no problem to install.

The aluminum chassis provides the foundation for mounting the suspension system. This chasis is very light and sturdy.

A three-speed-forward/one-speed-reverse, resistor type speed control is mounted on the radio tray above the batteries. I used the Kyosho 7.2-volt racing battery pack for power. A Mabuchi RS-540S motor is included in the kit.

The clear Lexan body includes a large aerodynamic wing that mounts to the roll cage. After using MRC/Tamiya* paint markers to detail the driver, the car was sprayed orange on the inside of the body. Stick-on decals supplied in the kit made the simple paint job look great.

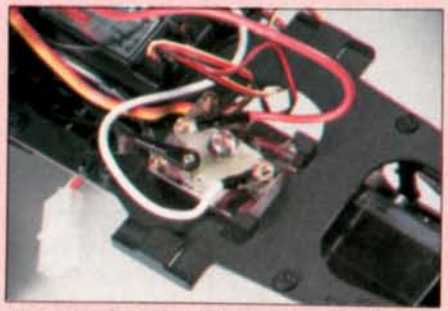
The multicharger has a discharge cycle that is connected to the ammeter. This helps you to cycle your batteries completely before recharging. When you do recharge, you can variably adjust the rate of charge. The electronic timer gives you a choice of 3 minutes to 30 minutes before the alarm goes off. There is a handy reference chart on the side of the charger to help you determine the rate and length of charge for your battery pack.

PERFORMANCE. Driving the Ultima was fun. This car takes bumps and ruts in stride. After jumps, it comes back down on all fours. The rear end really gets good traction. The low-profile tires help keep the center of gravity low for better stability.

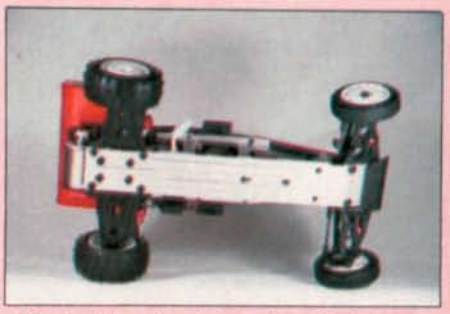
(Continued on page 110)

The Pulsar Pro 2000 transmitter is easy to handle.

The gear ratios are easy to change, just remove the gear cover and you'll find the aluminum motor pinion.



The three-stage resistor speed controller attaches to the radio tray.



The aluminum chassis is sturdy and lightweight.

photos by RICH HEMSTREET

ULTIMA UPDATE

by RICH HEMSTREET

WHEN INTRODUCING the Ultima late in 1986, Kyosho boldly claimed it would be the next 2WD World Champion. At the time, the RC10 was the reigning off-road champion and Associated planned to repeat in '87, but the brash new kid on the block looked like it was going to be a contender from the start. It was lightweight, had plenty of suspension travel, and the gearbox seemed to be efficient, but serious competitors doubted that the standard planetary gear differential would be up to the demands of international competition. Kyosho addressed this problem by developing a replacement ball differential under its Option House label. Thorp Manufacturing also introduced a ball diff unit for the Ultima.

Next came the development of the suspension system for international competition. The only parts that really required replacement were the red shocks. Surprise, surprise: The Kyosho Gold shocks bolted right in place and brought the car under control. Trinity introduced a flat, graphite chassis that Joel Johnson used on his World Championship-winning ride.

After the Ultima won the title, it became obvious this car was going to be around for a while and the aftermarket manufacturers went to work. RCRC came up with a sprint-car conversion kit; JG Manufacturing put together an Ultima Monster Truck Conversion; and now J Car has made its DDS direct-drive gearbox available to *really* get the Ultima cranking out laps on the dirt ovals.

Kyosho has continued to upgrade the Ultima series, first with the Turbo Ultima and now with the Ultima Pro. Except for the shocks, the suspension system has remained basically the same as when it was originally introduced. The competition will be tough in this year's 2WD World Championship, and Kyosho's defender will still have many parts that are interchangeable with the original Ultima. ■

There was excessive understeer my first time out, but, by softening the front springs and tightening the rear springs a little, I was able to correct it.

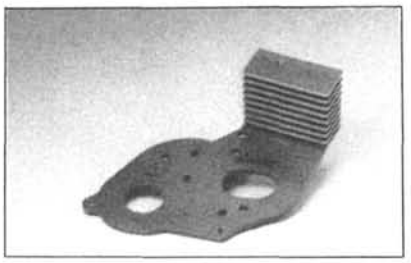
The RS-540S was quick, but not overpowering. Any of the hot Kyosho motors will bolt right into the Ultima, and several gear ratios are also available. The Pulsar radio transmitter is the most comfortable grip that I've ever used, and it's balanced so there's very little strain on your wrist.

One very important option is a full set of ball bearings. In the standard kit, there are bushings everywhere you want to have ball bearings. The Ultima's worst feature is the plastic bushings for the front tires. These should be replaced with bearings as soon as possible.

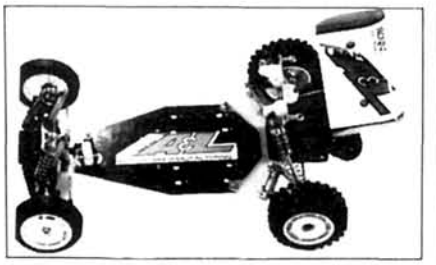
Can the Ultima win the world championship? The suspension and chassis are certainly up to it, and bearings and a hot motor can be added easily. Probably the

SECOND-LOOK SERIES BUYER'S GUIDE

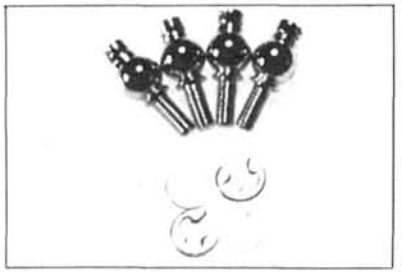
When it became obvious that the Ultima was here to stay, the after-market manufacturers went into production. Here are just a few of the items you might want to use on your Ultima. For that matter, most of these items will bolt right on to any of the Ultima family, including the Turbo and the brand-new Pro.



Since heat is a motor's worst enemy, Litespeed has introduced the Litesink, which is designed to keep heat to a minimum with over 15 square inches of heat-exchange surface. Lower temperatures mean extended brush and bearing life, as well as increased run time.

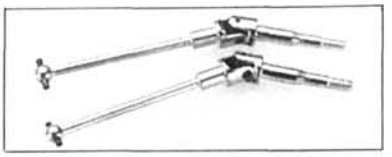


Allec & Lane offers a conversion for the Ultima, using an after-market graphite chassis for its famous trailing arms. This conversion allows fast, precise installation from the stock suspension to the A&L trailing arms. Gain rear stability and traction while putting "driveability" into those modified motors.

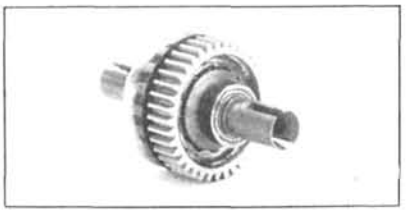


To prevent linkages from popping off in a collision, Trinity offers these Safety Balls. The unique design of the Safety Balls features a groove that's machined above where the rod end mounts for installing an E-clip. The E-clip holds the linkage rods securely without inhibiting the suspension.

Make your Ultima into a killer oval racer with BoLINK's Ultima sprint-car kit. The kit includes two shocks, BoLINK's sprint-car body with wing, body mounts, decal sheets and all the necessary hardware to lower the chassis for superior handling.



Tired of lost or worn-out dogbones? These Kyosho Option House drive shafts connect a swing arm to a drive joint with an actual universal joint. These heavy-duty linkages replace the axle and dogbone with a single unit.



For the smoothest possible transfer of power to the ground, Kyosho offers this ball differential. It's easy to install, use and adjust, and it's a perfect replacement for the standard gear differential. This diff is designed to give the serious racer better handling and

main item Kyosho needs is a world-class driver to run the Ultima. The present 2WD world-champion manufacturer should keep watching the rear-view mirror: The Ultima might be closing in!

**Here are the addresses of the companies mentioned in this article:*
***Great Planes Model Distributors**, P.O. Box 4021, Champaign, IL 61820.*
***MRC/Tamiya**, 200 Carter Dr., P.O. Box 267, Edison, NJ 08818.* ■

KYOSHO

ULTIMA

Type ..... 2WD off-road
Scale 1/10
Sug. Retail Price $199.95

DIMENSIONS:
Overall Length ..... 14.3125 inches
Width ..... 9.375 inches
Height ..... 5.1875 inches
Wheelbase ..... 10.3125 inches
Front Track ..... 7.75 inches
Rear Track ..... 7.875 inches

WEIGHT:
Gross (w/bat.) ..... 52 ounces

BODY:
Type ..... Buggy w/roll cage
Material ..... Lexan

CHASSIS:
Type ..... Ladder
Material ..... Aluminum

DRIVE TRAIN:
Type ..... Pinion/spur
Differential ..... Planetary gear
Bearings/bushings ..... Plastic

SUSPENSION:
Type (f/r) ..... Lower A-arm w/upper link
Dampening (f/r) ..... Oil-filled coil-over

WHEELS:
Front: Type ..... 3-piece plastic
Dimensions (DxW) ..... 2x.8125 inches
Rear: Type ..... 3-piece plastic
Dimensions (DxW) ..... 2.125x1.375 inches

TIRES:
Front ..... Ribbed
Rear ..... Knobby

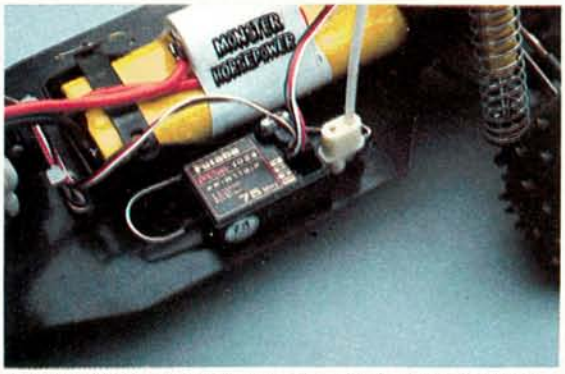
ELECTRICS:
Motor ..... 540 Mabuchi
Battery Req'd. ..... 7.2 to 8.4V flat pack
Speed Controller ..... 3-step resistor

OPTIONS AS TESTED:
Pulsar Pro 2000 radio

COMMENTS:
While the suspension and chassis have proven to be a base for championship competition, the plastic bushings are completely unacceptable. Bronze bushings, if not ball bearings, should be included. The basic Ultima is a solid car that can be made competitive at any level.

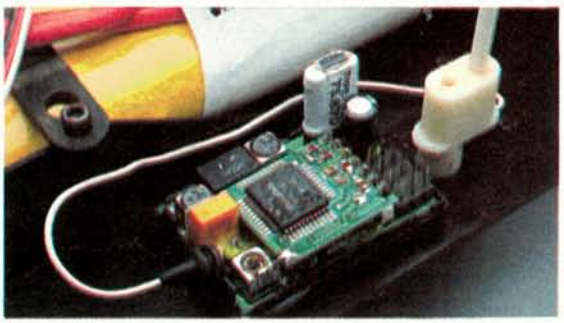
FUTABA PCM 1024

by STEVE POND



The smallness of the PCM receiver makes this radio system a shoo-in for just about any surface application.

While the PCM's control panel may look a little confusing at first, each of these bells and whistles has a practical application, particularly when using the system for more than one application.



Just a glance at the PCM's receiver tells you right off the bat that you're not dealing with the average AM system. Note the computer chip for processing the signals received from the transmitter.

Perfection: quality or state of being; highest degree of excellence

SINCE THE DAYS of the single-channel Reed transmitters and escapement actuating systems, R/C modelers and manufacturers have been seeking a more reliable means of controlling models. Current radio systems designed specifically for use in R/C cars are considerably more capable of controlled guidance.

The most recent addition to the Futaba* line of R/C systems—the Magnum PCM 1024—is one of the most significant breakthroughs since the inception of R/C, and it's undoubtedly the Rolls-Royce of radio control. The radio set is available with five different servos that range from the FP-S9601 (equivalent of the FP-S135S) mini servo with 33.3 ounce/inches of torque, to the behemoth FP-S3301 (similar to the FP-S134), which has a whopping 111 ounce/inches of

torque for 1/4-scale cars. One version of the radio also includes Futaba's top-of-the-line FP-MC116 electronic speed controller. Other items included with the PCM system are the small FP-113iP PCM receiver, the NT-8LP Ni-Cd transmitter battery and a charger.

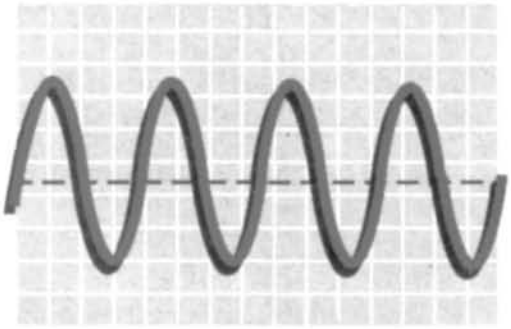
The main feature of the system is its transmission of signals in *pulse-code modulation* instead of the standard AM wavelengths. In simpler terms, this means that this radio system is virtually *immune* to the sources of interference that affect all other radios. Apart from the PCM circuitry, the new top-of-the line Magnum has a myriad of other features that seem, at first glance, almost overwhelming.

Starting with the steering wheel, the adjustments include wheel-tension adjustment; dual-rate steering; wheel-angle adjustment; steering sub-trim; one-touch electronic trim adjustment; and exponential and adjustable travel volume (ATV). Confused yet? The technical names might have you scratching your head, but each feature does have a practical application.

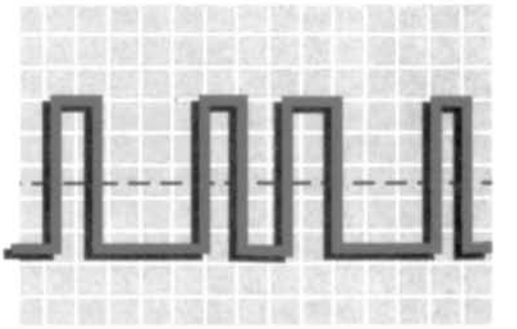
The wheel-tension adjustment is just what its name implies. The wheel is spring-loaded to return to the neutral point, and adjusting the spring tension will either require more or less effort for turning. The dual-rate adjustment is located within thumb's reach, while your left hand is at the "ready" position on the pistol grip. This location allows adjustment while driving, but I recommend that you make adjustments during set-up.

The dual rate simultaneously adjusts the left and right throw of the steering servo down to 20 percent of maximum operation. This could be helpful in situations where you find yourself oversteering in the turns, but I prefer full operation of the servo in case I need a little extra steering to get out of a jam. Wheel-angle adjustment determines how far you have to turn the wheel to obtain maximum servo travel. At minimum angle, the wheel must be turned 60 degrees for maximum servo travel. At maximum angle, the wheel must be turned 76 degrees for maximum servo travel. Here again, I prefer the maximum angle of 76 degrees, which makes the steering a little less sensitive to erratic movement and allows for

What is PCM?



AM



PCM

PULSE CODE MODULATION, or PCM, is a departure from the standard AM or FM methods of transmitting a signal to a receiver. The AM and FM methods are identical to those used for transmitting signals to your home stereo or portable radio. The signal is transmitted in wavelengths, and, as the name implies, it's very similar in shape to an ocean wave. Operating under perfect conditions, these systems would probably perform flawlessly. In this day and age, however, the airwaves are always cluttered with millions of wireless transmissions—some extremely powerful—and the potential for crippling interference is always present.

A PCM system transmits its signal entirely differently from the AM or FM types. It's much more sophisticated and discriminating, because it can recognize and refuse signals that are outside its receiving parameters.

The method the PCM uses to transmit a signal is nearly identical to the binary digit system used in computers. Each signal to the "brain" (receiver/decoder) is recognized as either a 0 or a 1. The order and spacing in which they are received determines the reaction. Each pulse sent out by the transmitter is either a 0 or 1 (on or off). This results in a wave the shape of a square-toothed saw blade. The microchip receiver can recognize any signal outside these parameters. It can either reject intermittent interference, or, if the fail-safe mode is selected and the interference continues, it will go to a pre-determined servo setting—usually throttle-off.

While no system is 100-percent flawless, the PCM method of transmitting offers the safest, most reliable means of radio control available—short of connecting a long cord to your car!

PCM

SPECIFICATIONS

TRANSMITTER FP-3PB

Operating system: Pistol-grip 3-channel transmitter
Frequency module: FP-TL-FM
Transmitting frequency: 27, 29, 40, 72 or 75MHz band
Modulation: FM-PCM/PPM switching
Power requirement: 7 penlight batteries (10.5V) or 9.6V Ni-Cd battery pack
Current drain: 200mA

RECEIVER FP-R113iP

Miniature 3-channel PCM receiver
Receiving frequency: 27, 29, 40, 72 or 75MHz band
Intermediate frequency: 455kHz
Power requirement: 4.8V or 6V
Current drain: 16mA
Dimensions: 1.68x1.13x0.63 inches
Weight: 0.74 ounces
Receiving range: 330 yards on the ground (differs with the surrounding conditions)

SERVOS

Control system: + pulse width control 1520µs neutral
Operating angle: One side 45° or more (including trim)
Power requirement: 4.8V or 6V, shared with receiver
Current drain: 12mA at 6V (idle)

Servo	Output Torque	Operating Speed	Dimensions	Weight
FP-S9601	33.3 oz/in	0.15S/60°	1.22"x0.63"x1.19"	1.09 ozs.
FP-S9401	44.4 oz/in	0.16S/60°	1.59"x0.79"x1.40"	1.76 ozs.
FP-S9301	69.4 oz/in	0.22S/60°	1.59"x0.79"x1.40"	1.76 ozs.
FP-S3301	111.0 oz/in	0.19S/60°	2.33"x1.13"x1.46"	3.32 ozs.
FP-S132H	25.0 oz/in	0.13S/60°	1.46"x0.71"x1.20"	1.13 ozs.

a larger margin of error.

The steering sub-trim is located inside the fighter-cockpit-style control panel, thus permitting you to adjust the trim before setting your car on the track. The one-touch electronic trim permits on-the-fly steering trim, because the left and right buttons are located just above the steering wheel, well within the reach of your index finger while your hand is on the wheel. The advantage of the one-touch trim is that in small increments (20 steps to either side), trim can be adjusted without overcompensating. (Those of you who have tried this with the conventional wheel adjuster will know what I'm talking about.) Each trim movement is indicated on the LED (light-emitting diode) scale that's just to the left of the on/off switch. The steering exponential could be used to advantage, as it determines how quickly the steering servo will react to steering wheel movement. On high-traction surfaces, the exponential can be adjusted to slow steering-servo movement from the neutral position, while sharply increasing the response at the limits of travel. At the other end of the spectrum, the exponential can be adjusted for low-traction surfaces for increased servo movement from the neutral point, while softening the response at the end of the servo travel. Finally, the steering ATV is another endpoint adjustment that's similar to the dual rate, but it allows *independent* adjustment of the left and right steering angles.

The throttle functions are very much the same as the steering, with adjustable-travel volume; exponential; sub-trim; one-touch electronic trim; throttle-neutral adjuster; and an adjustable throttle limiter. The ATV independently limits the left and right throw of the throttle servo. This is especially helpful when you're using a mechanical speed controller and you want to prevent the wiper arm from traveling off the contacts. The throttle exponential can be a tremendous advantage when you're driving on a slippery off-road track—especially with 2WD cars. Just as with the steering, the throttle exponential can be set to slow the response at lower speeds, where you're most likely to lose traction. As you get closer to the full-speed position, the throttle curve ramps up to full speed rather sharply. For applications such as drag racing, the exponential can be set to quicken the low-end throttle response, which then smooths out at the top end. The sub-trim and one-touch electronic trim are similar to the steering trims in that the sub-trim is used for an approximate setting on the workbench, and the one-touch is used for fine adjustments at the track.

The throttle-neutral adjuster sets the trigger position. In the half position, the throttle trigger has equal movement for both forward and reverse. In the one-third position, the throttle uses two-thirds of the trigger travel, while the brake (or reverse) side of the trigger uses one-third of the travel. A throttle-preset switch, which works in conjunction with the throttle-neutral adjuster, is located on the radio's control panel, and it permits equal left-to-right servo travel, even when the throttle trigger is in the one-third position. This allows smoother forward operation while reaching maximum reverse or brake limits. The adjustable throttle limiter permits fast full-speed adjustment with a knob located just above the LED servo-trim indicators. Wow, right?! Hold on to your hats; were only halfway there!

Tucked away behind the smoke-colored panel that houses many of the aforementioned features are a few other noteworthy functions: Three fail-safe functions ensure that, in the

(Continued on page 150)

WHAT'S NEW

ASTRO AC/DC CHARGER

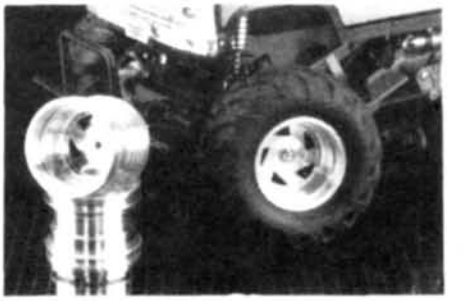
For the ultimate in simplicity and versatility, you can't beat the AstroFlight Model 114 Six/Seven-Cell AC/DC Charger. There are no complicated adjustments to confuse the beginner. You just plug into your 6- or 7-cell Ni-Cd and set the timer. The Model 114 works from both 12V DC and from 110V AC. It charges all 6- and 7-cell Ni-Cd racing packs, from 1200mAh to 4000mAh. The AstroFlight Model 114 delivers faster and more reliable charges than the competition. In head-to-head comparison tests, the Model 114 charged a 6-cell Sanyo 1200 SCR racing pack in just 15 minutes, and a 6-cell Sanyo 1700 SCE racing pack in just 20 minutes. It charges 4000mAh truck packs in 45 minutes. The reason is simple: this heavy-duty, American-made transformer puts out more juice. The proof is there on the meter!

For more information, contact AstroFlight, 13311 Beach Avenue, Marina Del Rey, CA 90292.

BOLINK ROAR LOGOS

BoLINK now offers two sheets of official ROAR logos that come in two colors: one black and one white.

For more information, contact BoLINK R/C Cars, Inc., 420 Hosea Rd., Lawrenceville, GA 30245.



SEES DIRECTIONAL SPOKE WHEELS

Adding to its line of machined aluminum wheels, Sees now offers one-piece directionally spoked wheels for the RC10, Blackfoot, JR-X2 and Kyosho cars. These wheels are designed and manufactured using some of the most advanced equipment to ensure the highest quality standards. Because they are machined from solid aluminum bar instead of die-cast material, these wheels have a show-quality finish right out of the box, not to mention added durability and light overall weight.

For more information, contact Sees Precision Machine Works, 1414 West 134th Street, Unit 2, Gardena, CA 90249.

CUSTOM SCALE COMPONENTS TELESCOPING AXLES

Custom Scale Components now offer Telescoping Axles for RC10 and Ultima-style cars with 5mm differential output shafts (MIP, Thorp and Kyosho). The axles are 3/8 inch in diameter and will fit A-arm or trailing-arm suspensions. Both kits include hardened-steel stub axles that are required for installation.

For more information, contact Custom Scale Components, 1807 South Washington, Suite 363, Naperville, IL 60565.

KYOSHO ULTIMA PRO

This souped-up 14.4-inch long, 1/10-scale 2WD buggy has a ball differential, front and rear stabilizers, Kyosho Gold Shocks, a motor protector, a complete ball bearing set, and much more. Its lightweight graphite chassis allows modelers to set up this race machine any way they want. New low-profile mini-spike tires are also included for great traction in tight turns, along with fluorescent-colored wheels to give the Ultima Pro greater visibility on the track. A motor and a 2-channel radio with electronic speed control are required. The Ultima Pro is the latest addition to the winning Ultima tradition.

For more information, contact Great Planes Model Distributors Co., P.O. Box 4021, Champaign, IL 61820.

PARMA OPTIMA-MID BODY

Parma offers a direct replacement body for the Optima Mid, complete with undertray and wing kit. The Concept 4 is designed to give your car unsurpassed aerodynamics, great looks and dirt-free operation of the sensitive electrical components. The Concept 4 undertray and body are also available separately.

For more information, contact Parma International, 13927 Progress Pkwy., North Royalton, OH 44133.

Descriptions of new products appearing on these pages were derived from press releases supplied by the manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by **Radio Control Car Action,** nor guarantee product performance or safety. When writing to the manufacturer about any product described here, be sure to mention that you read about it in **Radio Control Car Action.**

TEAM ASSOCIATED YOKOMO YZ-10

This new version of the Yokomo car, designed exclusively for Team Associated, is already a big winner in 1989. In the Second Annual Reedy International Race of Champions, where all the international factory teams participated, the new Yokomo YZ-10 finished 1st, 2nd and 3rd overall. At the 1989 Florida Winter Championships, with 320 entries, and all the USA teams competing, it again took 1st, 2nd and 3rd. If you're looking for the best 1/10-scale 4WD off-road car, the Yokomo YZ-10 is the latest state-of-the-art competition racing car.

For more information, contact Associated Electrics, Inc., 3585 Cadillac Ave., Costa Mesa, CA 927626.

TRINITY LIGHTWEIGHT WHEELS

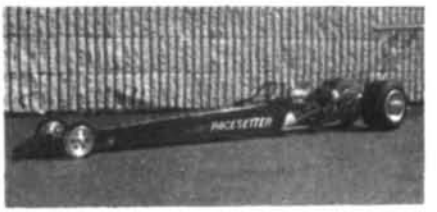
Trinity now offers lightweight 5-spoke replacement wheels designed for use on the Team Losi JR-X2 and the Associated RC10. These wheels are designed to mount without any modifications and without the need for heavy universal adapters. For use with all popular 2.1-inch-diameter tires.

For more information, contact Trinity, 1901 E. Linden Ave., #8, Linden, NJ 07036.

TEAM HAMMER DURA-SHIELD

Dura-Shield is a revolutionary new product from Team Hammer that's specifically designed to clean, polish and protect polycarbonate (Lexan) R/C racecar bodies and wings. Dura-Shield incorporates an exclusive formula that thoroughly cleans R/C racing shells. It also adds a protective coating that helps the shell resist dust, dirt and minor scuffing. Dura-Shield not only enhances the beauty of your car's finish, but also helps to preserve that finish longer.

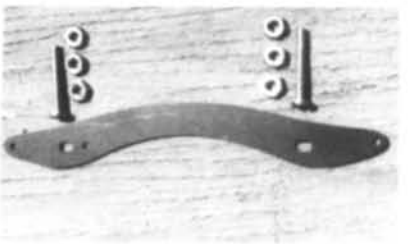
For more information, contact Team Hammer, 12922 Harbor Boulevard, Suite 574, Garden Grove, CA 92640.



M.K./PACESETTER M.K. FUELER

M.K. Engineering/Pacesetter Products introduces the ultimate in 1/4-scale drag cars. The M.K. Fueler features a completely redesigned car with a 4130 chrome moly chassis, a polished stainless-steel A-arm front end and wing stand, an all-aluminum body, a 2-stage clutch, and much more! The car's quality has been brought up to the level you'd expect from M.K.

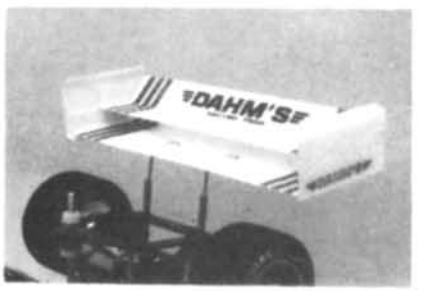
For further information, contact M.K. Engineering/Pacesetter Products of N.Y., Inc., 60-U Corbin Ave., Bay Shore, NY 11706.



SUPER SPORT RACING TOP CROSSBAR

Use what the pros are using at Whippoorwill International Speedway. This Top Crossbar ties your king pins together at the top, and is then anchored to the bottom crossbar to make the front end bulletproof. The top crossbar is adjustable for camber, thus giving you longer tire life and better handling. You won't bend or break any more king pins, cone any more tires, or break any more expensive bottom crossbars. Available for BoLINK Eliminator 10 and Predator on-road cars.

For more information, contact Super Sport Racing Products, 8199 82nd Street N., Seminole, FL 34647.



DAHM'S GT WING KIT

The 3x9-inch GT Wing is designed for 1/10-scale GT, Can Am, GTU, IMSA, GTP, Sports, Formula, and Grand National/ASA racing cars. A clear Lexan bi-wing with adjustable rear flaps, the GT Wing comes with pre-cut Lexan wing pieces, super-stick two-sided wing tape, instructions and Dahm's decals.

For more information, contact Dahm's, P.O. Box 386, Cupertino, CA 95015-0386.

WHAT'S NEW

TAMIYA MUD BLASTER

When it comes to down-and-dirty monster-truck fun, it's usually an MRC/Tamiya truck that beats all opponents in reliability and performance. Another thoroughbred has been added to the stable of R/C monster movers: the Mud Blaster. First, you'll notice those tractor pin-spike tires that are excellent dirt-grabbers. The tires are mounted on bright-yellow one-piece rims for light weight, durability and ease of assembly. A double-wishbone front suspension and rear trailing arms provide a fully independent suspension ride with coil springs all around. Within the ABS plastic resin space-frame chassis will rest the 2-channel R/C system that you provide. The 3-step forward and reverse speed control is equipped with a BEC connector. Power is provided by a 540-type motor, moving the 2WD system through a proven differential gear system. Perched high on top of the chassis is an ever-popular rendition of the Subaru Brat pickup-truck body. The detail in the injection-molded plastic body makes it superior for customizing.

For more information, contact Model Rectifier Corp., 200 Carter Drive, P.O. Box 267, Edison, NJ 08818.

COMPOSITECRAFT YOKOMO CHASSIS PARTS

CompositeCraft has a host of graphite chassis parts for the Yokomo YZ-10/C4. These high-quality parts include a graphite chassis, graphite shock mount (front and rear) and a graphite backbone. Now there's no more need to search for those elusive factory chassis parts!

For more information, contact CompositeCraft, Inc., 2400 Sand Lake Road, Orlando, FL 32809

PRO-LINE THE DIRT FLIRT

The Dirt Flirt took the ROAR 2WD Modified Nationals at Antioch last year. This new front racing tire fits Pro-Line Nos. 2522, 2523, 2530 and other 2.1-inch front wheels. The Dirt Flirt's low-profile pin-spike tread pattern is designed to maximize your car's performance on most dirt surfaces.

For more information, contact Pro-Line, P.O. Box 456, Beaumont, CA 92223.

MRP CHEVY LUMINA

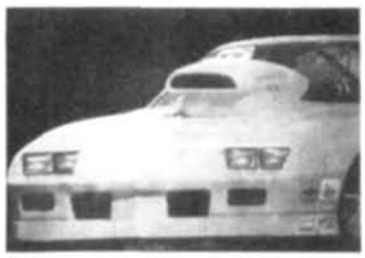
Model Racing Products (MRP) proudly introduces its latest 1/10-scale stock-car body, the 1990 Chevrolet Lumina. This is Chevrolet's aerodynamic answer to the Ford Thunderbird. Continuing the tradition of superior car bodies, MRP's Lumina truly replicates the actual car, while providing the ground-hugging performance needed for on-road R/C racing.

For more information, contact Model Racing Products, 18676 142nd Ave. Northeast, Woodinville, WA 98072.

COX HOBBIES FUEL-POWERED GTP

Now in 1/12 scale, R/C drivers can experience the realistic sight, sound and smell of fuel-powered GTP race cars. Just imagine yourself at the wheel and throttle of the new Cox .049 GTP Nissan, developed especially for on-road R/C gas-powered oval and road racecourses. With its fiberglass chassis, molded suspension components, nylon wheels and foam tires, this highly efficient design is simple to assemble, maintain and customize. An efficient design minimizes weight to maximize performance. A ratchet pull-starter eliminates expensive electric starters and, once running, the 1.5-ounce fuel tank yields 15 minutes of flat-out racing fun. Fully proportional throttle control and brake gives total control to the driver.

For more information, contact Cox Hobbies, Inc., 1525 E. Warner Avenue, Santa Ana, CA 92706.



BRAY'S ENGINEERING PRO STOCK HOOD SCOOP

Bray's Engineering is now offering a new style Pro-Stock Hood Scoop (for 1/12- and 1/10-scale cars) with a realistic and aerodynamic-looking scoop. It can be made to fit any 1/12- and 1/10-scale car.

For more information, contact Bray's Engineering, R. #1 Box 96C, Milford, IN 46542.

BEHEMOTH

(Continued from page 37)

original Blackfoot, and that's not bad, considering it's carrying nearly two and a half times the weight the 'Foot did.

And the Behemoth is rugged as well. In the interests of speculative science, I pegged the trigger into reverse and closed my eyes. The back of the truck was about 5 feet from—and aimed *at*—an aluminum reinforced plasterboard wall. It wasn't very long before the crash! The plasterboard had a hole in it. The body had "un-Velcro'd" itself from the mounts and landed upside-down on the concrete floor—undamaged! The rear bumper bracket was bent (the bracket, not the bumper), but everything else was fine. I needed a pair of pliers and about three minutes to straighten the bracket. I didn't stay around long enough to determine the extent of the damage to the wall.

What's Next?

Obviously, the Behemoth needs a few

(Continued on page 124)

BEHEMOTH

(Continued from page 122)

more modifications, foremost among which is the addition of another pair of shocks to the front. The original rear Blackfoot dampers will apparently fit the bill. I'll just have to make a bracket to mount them to the front upright.

I'm also thinking about making an articulated joint between the cab and the bed of the truck—just the sort tractor-trailers have. That should help shorten the turning radius.

Then there's the matter of options. Both the fog lights on the roll bar and the headlights are functional RAM units currently operated manually. Moving over to a 3-channel radio would give me control over them on the fly. And if I want to borrow the 4-channel radio I use with my Bruiser, I can add a "hydraulic" lift feature to the Behemoth's front cab. It's just glitz, but that's one of the reasons I built the truck: It will give me a chance to try quite a few

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BEHEMOTH

(Continued from page 124)

different things.

Of course, I could always start an R/C wall-bashing event, but I think I have an unfair advantage—I already know the course!

**Here are the addresses of the companies mentioned in this article:*
Hot Trick Racing Cars, Inc., *1157 Cushman Ave., San Diego, CA 92110.*
Thorp Manufacturing, *380 S. East End, Unit H, Pomona, CA 91766.*
Tamiya/MRC, *200 Carter Dr., P.O. Box 267, Edison, NJ 08818.*
Bru-Line Industries, Inc., *P.O. Box 3786, Center Line, MI 48015.*
Kyosho; *distributed by Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.*
K&B Manufacturing, *12152 Woodruff Ave., Downey, CA 90241.*
CRP, *2600 South California, Unit H, Monrovia CA 91016.*
Trinity, *1901 E. Linden Ave., #20, Linden, NJ, 07036.*
Aristo-Craft/Polk's, *346 Bergen Ave., Jersey City, NJ 07304.*
Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.* ■

TROUBLESHOOTING

(Continued from page 38)

vos and speed control are clean and dry. Check for signs of rust on the contact points of your speed control, and clean and re-lubricate them if necessary.

In addition to checking and cleaning structural and electrical components, proper lubrication of moving parts plays a key role in performance. Correct lubrication not only reduces wheel friction but also allows smooth steering. Be sure to

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TROUBLESHOOTING

(Continued from page 126)

lubricate any meshing gears in your car and check for worn or broken teeth. Use a spray-on-type cleaner in these areas to flush away those damaging particles of dirt and dust; then be sure to re-lubricate the gears. Don't forget to clean and grease the areas around the rear axle where it comes in contact with the wheel hubs. This helps to ensure effective transfer of power and reduces friction.

Suspension is often overlooked, too. Keep springs, hinges and shocks clean and well-lubricated, because if your tires don't rebound well and stay in contact with the track, the competition will leave you in the dust. Check the oil levels in your shocks, and lubricate the shock connecting points to prevent binding.

Keep these basic points in mind; let them become habits; and make the competition eat your dust! Good luck, and happy motoring! ■

PANDA STOCKER

(Continued from page 58)

Global appears to want to keep you interested in the Stocker. To this end, they make a number of hop-up parts with which to modify the car: oil-filled shocks with adjustable coil-over springs for the front and rear suspension; adjustable control links; a variety of front and rear tires; and a ball-bearing set.

To say that you'll open the Panda Stocker's box and find a 1/10-scale on-road world-beater would be misleading. To say that this is an outstanding addition to the ranks of entry-level cars would be more accurate. As a matter of fact, some of the other manufacturers could learn a few things from this car. While this is, indeed, an entry-level car, the inclusion of Oilite bushings (instead of those horrible plastic ones), upper control links and a detailed Lexan body (among other things) raises the Panda Stocker a notch above many other cars in the entry-level category.

**Here are the addresses of the manufacturers mentioned in this article:*
***Global Hobby Distributors,** 10725 Ellis Ave., Fountain Valley, CA 92728.*

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PANDA STOCKER

(Continued from page 135)

Associated Electrics, *3585 Cadillac Ave., Costa Mesa, CA 92626.*
Parma International Inc., *13927 Progress Pkwy., North Royalton, OH 44133.* ■

VOLT! OHM!

(Continued from page 80)

Milliamps stands for 1/1000 of an amp. Thus, 1200mA = 1.2 amps. So, it can also be said that this battery could supply 1.2 amps for 1 hour. Run time is computed by taking the milliamp rating, converting it to amps, and then dividing this number by current flow.

For example, take a 1200mAh battery and force it to deliver 12 amps to a motor system. How long will the motor run? 1200mA = 1.2 amp hours. 1.2 amp hours divided by 12 amps equals .1 hour. Our answer came out in hours; to get minutes, multiply by 60 (.1 hour x 60 = 6 minutes).

How much current will be flowing if I dump my 1200mAh pack in 4 minutes? Convert 1200mA to amp hours, then divide this number by amps: 1200mA equals 1.2 amp hours, 1.2 amp hours divided by .066 hours (4 minutes equals .066 hours) equals 18.2 amps. Of course, the real currents will always be less than the calculated value, because the amp-hour rating of a battery is valid only if you discharge the battery over a 10-hour time

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VOLT! OHM!

(Continued from page 136)

span; then the current is so small that there's no heat build-up and the battery has enough time to convert a lot more of its chemicals to current.

I hope this has helped. If you want to learn more about basic electronics, there's a raft of books available at your local library. To tell you the truth, understanding all this hasn't helped me to win. I still get beaten by those dreaded RC10s and the hammering Turbo Ultimas—guess I need to learn how to drive! ■

KYOSHO MAXXUM

(Continued from page 88)

but the kit's chart showing the LeMans 240ST motor suggests a 17- to 22-tooth pinion. To take advantage of the operating rev range of the motor, I switched to an 18-tooth. This motor seems very strong and, on a loose surface, will quickly overpower the car.

Be sure to use the motor guard as shown on page 21. FWD cars throw dirt and sand all over the car. Without the motor guard, a motor won't last very long, especially since the design leaves no room for a sponge motor cover.

PERFORMANCE: The Maxxum FF has really nice lines that attract immediate attention at the track, but the track had better be tacky if the Maxxum FF is to perform well. On a sandy track, the FWD (coupled with a loose differential) produces a lot of useless wheel spin. Starting from a standstill in deep sand, one front tire spins while the car just sits there.

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KYOSHO MAXXUM

(Continued from page 142)

When the surface provides a better grip, the car comes alive. FWD is fairly easy to drive and spin-outs are almost nonexistent, but the test is in the race results, so I'm going to take the Maxxum FF racing: off road, dirt oval and concrete oval. We'll find out where FWD works best and how to set it up to take advantage of its unorthodox drive-train layout. This car is unique, and it's going to take some time to sort it all out. The Maxxum needs an adjustable diff, so I've ordered an Ultima ball diff and I'll let you know how it works. The scuttlebutt is that a ball diff makes the Maxxum a lot more competitive.

Remember, in ROAR, FWD cars run in the 4WD classes, so the big question is: Can it compete with the 4WD cars? For NORRCA racing, the Maxxum competes in the 2WD class. We'll find out where it really belongs.

See you at the track!

**Here are the addresses of the manufacturers mentioned in this article:*
***Kyosho;** distributed by Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61620.*
***Associated Electrics,** 3585 Cadillac Ave., Costa Mesa, CA 92626.* ■

DIRT DIGEST

(Continued from page 91)

chassis is rising will slow down, but it will still develop momentum on its own.

The momentum adds itself to your friend, centrifugal force, and takes a close look at the attitude of your car. If the chassis has dipped far enough down so that the car's CG shifts sufficiently from the center line of the vehicle, you'll find yourself with an uncontrollable flying object.

To counter this, preload the right front spring when you're racing on tracks with high-speed left turns. When setting the spring collar on the shock absorber, push

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DIRT DIGEST

(Continued from page 144)

it down the shaft of the shock to add tension to the spring. Do the same to the right rear spring, but don't push it as far as you did the front one. Yes, that sounds as vague to me as it does to you, but the actual amount of preload you'll need depends on the track's surface conditions, the amount of banking (if any) in the turns, and whether you're using transversely mounted batteries or saddle packs (which affects the CG).

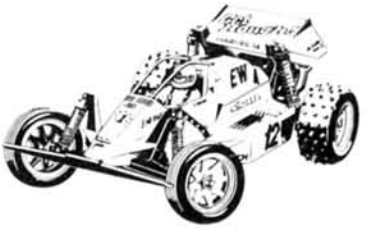
Be careful not to add too much preload. The trick may work great for the turns, but when you throw your suspension too far out of balance and then try to run a straight leg down a dirt track, you might find yourself driving a bobbing and weaving jack-in-the-box instead of a race car.

Generally, you can get a good feel for the track by just shifting the springs first. Once they've been set for a ballpark response, attack the front stabilizer to fine-tune the amount of chassis roll. It might mean that you'll have to go back to the springs for a final tweak, but, by then, your RC10 will be doing more power turns and less bicycling. Remember, try to make only one suspension change at a time, and then test the results.

Next Month

Bob has something planned for next month's column, but he's not letting the cat out of the bag. I promised to let him carry it all on his own, but, if he leaves me some room, I'll show you a stock Optima Mid chassis plate that didn't need Sherlock Holmes to find something wrong. Let's just say that I had a feeling that there was a problem in that area, and I finally disassembled one of my Mids to confirm it. Fixing the problem is another thing entirely.

In the meantime, we'd like to hear from anyone who's running a JR-X2 rear with an RC10 front end. We've heard that this is a hot setup and we're curious. See ya! ■



SPONSOR DECALS

(Continued from page 105)

artwork before you put it on the car body. Usually, the backing paper left over from the creation of the basic part of the design will do nicely.

Tape the photocopy of your design onto the face of the Mylar sheet by the edges, making sure that it lies flat against the Mylar sheet. With your hobby knife, cut through the photocopy paper and the Mylar film along the outside edge of the design. Try not to cut through the backing paper, because it can cause problems later on. Very carefully, peel the excess Mylar film away from the design. Pay particular attention to the corners of square numbers, letters and shapes, as they tend to stick to the material being peeled off.

If you're patient and you work slowly, you'll get good results. Start by cutting the basic part of the design. If you have a two-color logo, it's easiest to start with the most delicate part of the artwork, so that it doesn't have to be moved from the backing paper after it's cut. Even if you're careful, parts of a design may become distorted when they're moved, so move as few parts of a design as possible.

If your design uses only one color, your next step is to lift all of the parts off of the backing paper together. Use wide masking tape to stick to the graphic and peel it from the backing paper. Position the tape on the body, stick the tape and the design to the car body, and rub the edges of the design through the masking tape with something hard and smooth. A screwdriver handle or the handle of a hobby knife works well. Now, very carefully, peel off the masking tape, leaving the design stuck to the body. Again, the edges of the design will often remain stuck to the masking tape instead of to the body. If this happens, use the tip of your tweezers or the point of the hobby knife to hold that part of the design in place against the body as you continue to peel off the masking tape.

For a graphic that has two or more colors, repeat the process of cutting out parts of the design using a different-colored Mylar. The really difficult part is when you move this second part of the design to the backing paper of the basic design. You must pick up each part of the new color with the tweezers or the point of the knife and position them on the backing paper of the basic part of the design. If you don't press them too hard against the backing paper, you can slide the pieces of the design around a little to get them properly positioned. When you're satisfied with the positioning, pick up the entire design with the wide masking tape and position it on the car body as described before.

Designs that are on a solid color background can be made by picking up the basic design with the masking tape and sticking it to the proper color Mylar sheet. Remove the masking tape and cut out the shape of the background with scissors. Peel off the backing paper and stick the whole thing in position on the car body.

Voilà! You're finished. Concours competition, here we come! Don't overlook the commercial aspects of this project. Like their full-sized counterparts, you may be able to get a local business to sponsor your car. Even if they'll only pay for the cost of a body, it helps. In any case, the effort involved in a project like this is worth all the attention you'll get from fellow racers at the track. You'll be known as the "master of graphics"!

**Here are the addresses of the companies mentioned in this article:*
***Top Flite,** 2635 S. Wabash Ave., Chicago, IL 60616.*
***Coverite,** 420 Babylon Rd., Horsham, PA 19044.*■

PCM RADIO

(Continued from page 116)

event of sustained interference or loss of power to the receiver, your car will still be under your control. With the fail-safe function turned off, the receiver will enter a "hold" state. The receiver will hold the servo or speed controller in the position it was in before interference was detected. After a 1/2 second, the radio will return to normal operation. With the fail-safe function in the "on" position, the throttle will move to a preset position (preferably neutral or brakes) when interference is encountered. This fail-safe is set simply by moving the throttle to the desired position and setting the fail-safe button. A third fail-safe will move the throttle to a preset position if battery power to the receiver is lost (except when using an FET speed controller).

To further increase the versatility of the PCM, a number of mixing options can be used with a third channel on the receiver. The PCM's predecessor—the Magnum Sr.—has a separate control for the third channel; this is a plus, but it was rather hard to use while trying to concentrate on racing.

The third channel on the PCM can be used in conjunction with either the steering or throttle channels. The third channel can be used for the 4WS that's popular on some of the newer monster trucks; for twin-servo steering for trucks or 1/4-scale cars; for simultaneous fuel-needle control for gas cars and boats; and for torque/steering compensation, which is most useful on surface-drive boats. This third channel is completely adjustable for rate and limit of mixing, so you aren't confined to the actions of the adjacent channel. (For example, nitro-powered cars require a rich needle setting for maximum high-speed performance, but this will usually result in a poor idle. With the use of the PCM's third channel, a remote needle can be used to lean-out the fuel mixture when you back off the throttle for a smooth idle.)

The final gadget behind door No. 3 is a switch marked "PCM/PPM," and it allows the transmitter to operate with an optional 3-channel FM receiver.

The new PCM also has a couple of other convenient features, but they don't enhance its performance. Serious racers, however, will certainly welcome them. An optional DSC cord (direct-servo connection) can be plugged into the transmitter and receiver, enabling you to run through all the radio functions without ever transmitting a signal. If you're able to persuade the axe-swinging hooded guard at the transmitter impound that there's no need for you to turn on your radio to check your trim settings, you'll avoid a lot of headaches when you're trying to complete these settings as you're on your way to the starting grid.

Another helpful feature is an alarm that beeps when the transmitter battery drops below the recommended operating range. This is especially helpful when using Ni-Cds (included with the PCM). Unlike alkaline batteries that discharge at a consistent rate, Ni-Cds maintain a very consistent voltage, and when they're finally drained, they drop very quickly. Too many times, I've wondered why I lost control of a car, only to find that the transmitter's Ni-Cd pack had dumped.

Last, but not least, are the interchangeable crystals. Just as with most other radios, the PCM facilitates quick frequency changes. The transmitter crystal must be removed from the RF module, which is available on 27, 29, 40, 72 and 75mHz bands. The receiver crystal can easily be plucked from the receiver. The PCM, however, requires FM-type crystals in-

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PCM RADIO

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stead of the standard AM crystals used in most of the popular car radios. With all these features, how does this thing perform?

Performance

Since receiving the PCM about six months ago, I've tested it in seven R/C cars, including a 2WD monster truck, a 4WD monster truck, a 1/10-scale pan car, a 1/12-scale pan car, two 2WD off-roaders and a 4WD off-roader. Not once during the course of normal operation did I encounter *any* interference. To really put its interference-rejection capabilities to the test, I made a number of deliberate attempts to trip up the PCM. These included running without capacitors, taping the antenna directly to a graphite chassis and finally turning on three other radios using the same channel! Only by turning on the other radios could I blemish the PCM's perfect track record; but even then, the "hold" function simply kicked in and, instead of running completely out of control, the car couldn't move. With the failsafe activated and the car running on the track, the PCM still turned in a textbook performance when the three radios were turned on.

"How's the range," you say? I decided to put the claimed 300-meter range to the test by taking the 1/10-scale pan car down a long, straight road until it was out of range...sure! I was able to take the car so far down the road that I could barely see it, and I was *always* in control. After asking my brother to give me hand signals when I couldn't see what the car was doing, I was able to reach the end of the road, which was a good 800 feet away (farther than an R/C car should ever get away from you!). There isn't much you can do to fool *this* system.

In short, this is about as close to getting *in* the car and actually driving it as you'll ever get. The PCM's many features make it the most versatile surface R/C system ever available. Will this radio allow you to turn faster lap times? No! There's no substitute for driving skill, and paying the healthy price tag of the PCM won't provide a short cut. Practice and dedication are still paramount. But if you're a serious competitive racer and you think this radio would make your racing efforts more enjoyable by eliminating worry about interference, the Magnum PCM 1024 might be the way to go.

**Here's the address of the manufacturer featured in this article:*
***Futaba Corp. of America**, 4 Studebaker, Irvine,*

TRACK DIRECTORY

In keeping with our constant efforts to help foster the growth of the radio-control car hobby, we've decided to run this track directory intermittently to inform modelers where they can race and exchange ideas. If you'd like your track listed, send us your name, address, phone number and some information about the track to **R/C Car Action Track Directory,** 251 Danbury Road, Wilton, CT 06897. We'll list as many clubs as space allows.

MARYLAND

BALTIMORE ROUGH RIDERS OFF-ROAD R/C CLUB
2800 Pelham Ave., Baltimore, 21213
Rick Gondeck Sr. (301) 488-8615

CENTRAL MARYLAND ELECTRIC RACING CLUB (CMERC)
Middletown Park, Middletown
Mark Coats (301) 694-7420
Paul Sabine (301) 775-2494

DOUG'S HOBBY SHOP RACEWAY
Rt. 301, Box 96-C, Waldorf, 20601
Bill Holley (301) 843-6220
Patrick Gunn (301) 843-7774

KING'S R/C CARS
219 East Washington St.
Hagerstown, 21740 (301) 739-0080

DUSTBUSTERS R/C CLUB
5004 - 70th Pl., Hyattsville, 20784
Jeff Swartz (301) 773-7230

CHESAPEAKE DELMARRA R/C
Bill Rece (301) 643-5733

R&R R/C
84 E. Main St., Westminster, 21157
Donna or Rick (301) 848-2144

CMERC COMMUNITY R/C SPEEDWAY
Middletown Park, Middletown
John Mauchamer (301) 698-9545

COCKEYSVILLE ASTRODOME RACERS, INC.
Rear of 10854 York Rd., Cockeysville
Art LaPole (301) 666-1098

MASSACHUSETTS

NORTHBORO SPEEDWAY EVERYBODY'S BICYCLE & HOBBY SHOP
172 Main St., Rte. 20, Northboro, 01532
(617) 393-2691

CKS R/C RACEWAY
46 Wilbraham St. (Rt. 20), Palmer 01069
(413) 283-2260

NORTHBORO SPEEDWAY
Rt. 20 Northboro, 01532
Bob Trimble (617) 393-2691

CUSTOM MODEL PRODS. SPEEDWAY
1 Bert Dr., West Bridgewater, 02379
John Smith (617) 580-1622

HOBBY CITY
263 Lynnfield St., Lynn, 01904
Steve (617) 581-7361

MASSACHUSETTS SCALE RACERS
Holyoke, Rick Pepin (413) 736-7711

PINE BANKS R/C RACEWAY
35 Church St., Malden, 02148
Jimmy (617) 324-4465
or Brian (617) 322-9554

N.E. OFF-ROAD RACERS
600 N. Main St., Rte. 83, E. Longmeadow, 01028
Rick Pepin (413) 736-7711

R/C PERFORMANCE CENTER
Rt. 27, Hanson, 02341
John Webber (617) 294-8980

CMP SPEEDWAY
1-Bert Drive, Unit #5, W. Bridgewater
(617) 580-1622

PIT STOP RIVERSIDE RACING
44 South Main St., W. Bridgewater, 02379
(617) 586-7330

MICHIGAN

RED ARROW R/C RACEWAYS
9486 Red Arrow Hwy, Bridgman, 49106
(616) 465-6525

POINTE R/C MODELS
2119 S. Summerton Rd., Mt. Pleasant
Frank/Teresa Pointe (517) 773-5711

R/C USA RACEWAYS
6083 Dixie Hwy., Bridgeport, 48722
(517) 7777-USA

YMCA R/C RACERS
315 W. Main St., Niles, 49120 Paul Cooper (616) 683-1552 or Ric Clingaman (616) 683-3075

FLINT R/C CAR CLUB
Ralph Herndon (313) 658-5390
or Tom Hoos (313) 658-1043

TAIT'S HOBBIES & RACEWAY
3270 Bay Rd., Saginaw, 48603
Ron DeLarme/Don Tait (517) 799-3900

MASON COUNTY R/C CAR TRACK
Mason County Fairgrounds, Ludington
Tom Allard (601) 845-8553 or (601) 843-4837

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TRACK DIRECTORY

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JJ's R/C SPEEDSHOP
5645 13 Mile Rd., Warren
(313) 977-0420

MINNESOTA

NORTHLAND R/C SPEEDWAY
2020 Silver Bell Rd., Suite 34, Eagan 55122
(612) 687-9511

MISSISSIPPI

TEAM RACE R/C CLUB
505 Spring Ridge Rd., Clinton, 39056
Thomas Bullock (601) 924-3341

NORM'S RACEWAY
310 E. Beach, Long Beach
Norman Redo (601) 863-0524

MISSOURI

R/C HOBBY WORLD
113 S. 6th & Edmond, St. Joseph, 64501
(816) 233-4450

HOBBY HAVEN RACEWAY
10901-D Hickman Mills Dr., Kansas City, 64137
David Kinton (816) 763-9725

HOBBY VILLAGE AND RACEWAY
112 N.W. Business Park Ln.
Riverside, 64150 (816) 587-6435

CUSTOM R/C RACEWAY
12019 E. 47th St., Kansas City 64133
(816) 358-0238

MID-SOUTH SCALE AUTO RACING ASSOC.
Contact: Semo Hobbies, Cape Girardeau
(314) 334-4686 or (314) 887-6958

MONTANA

MIRACLE SPEEDWAY
300 Pheasant Dr., Kalispell 59901
(406) 756-RACE

NEBRASKA

ON-ROAD
7402 Plum Dale Rd., LaVista, 68128
Doc Holiday, V.P. (402) 339-7537

HOBBY TOWN RACEWAY
Sutter Place Mall, 5221 South 48th St.,
Lincoln 68505
(402) 464-2858

NEVADA

CIRCUS RACEWAY
3132 S. Highland, Las Vegas, 89109
(702) 732-0022

NEW HAMPSHIRE

BIRCH HILL RACING
Rt. 10, Winchester, 03470
(603) 239-8808

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TRACK DIRECTORY

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R/C DIRT RACERS OF N.E.
Woodsville, 03785
Bill Dolack (603) 747-2165

FOX RUN RACEWAY
Fox Run Rd., Newington

FOX RUN'S RACEWAY
200 Cass St., Portsmouth, 03801
Thom Belmont (603) 436-1112

NEW JERSEY

R/C DRAG RACING ASSOCIATION
17 S. Brighton Ave., Atlantic City, 08401
Warren M. Bader (609) 345-2671

ATLANTIC HOBBIES RACING WORLD
White Horse Pke., Elm, 08037 (609) 567-2947

CHIP-n-DALE
1240 Monmouth Rd., Mnt. Holly, 08060
Chris Currie (609) 261-1981

J&J REMOTE CONTROL RACING CLUB
1200 Springfield Rd., Union 07083
Jay Biondi (201) 687-6424

PARLOR HOBBIES
34 Broad St., Mattawan 07747
Charlie (201) 566-3158

NEW YORK

ISLAND HOBBIES AND RACEWAY
111 Bridge Rd., Happauge, 11788
Dave (516) 234-7428

THE DRAGON'S LAIR
15 Tieman Road, Scotia 12302
Jay (518) 399-8793

RAPID TRANSIT RACEWAY
2104 Broadway, Schenectady, 12306
(518) 372-0777

REC. R/C RACEWAY
187 Church Ln. and Creamery Rd.,
Stanfordville, NY 12581
Erin Clancy (914) 868-7715

SMALL TORQUE RACERS OF L.I.
24 Horton Dr., Huntington Sta., 11746
George Franz (516) 271-1119

WALLKILL WHEELS
Old General Slicing Bldg. Route 208
Walden, 12586 (914) 778-1413

SCHENECTADY R/C SPEEDWAY
955 State St., Schenectady, 12304
(518) 370-3747

N.E. SCALE CAR AUTO RACING
P.O. Box 118, N. Greece, 14515

NIAGARA HOBBY & CRAFT MART RACE-A-RAMA
3366 Union Road at Walden, Buffalo
Don Schrems (716) 681-1666

WALT'S HOBBY AND CRAFT
4300 W. Genesee St., Syracuse, 13219
(315) 468-6544

R/C WORLD
9110 5th Ave., Brooklyn, 11209
(718) 921-2160

SKANEATELES RC RACEWAY
W. Genesee St., U.S. Rt. 20 Skaneateles 13152
(315) 685-8077 or 685-5185

THE RADIO OPERATED MODEL AUTOMOBILE CLUB OF CENTRAL N.Y.
P.O. Box 93, Cicero, 13039

LAWRENCE RACE PARK
2509 Macedon Ctr. Rd., Palmyra, 14522
(315) 597-6429

N.Y. RADIO OPERATED CARS
Joe Fiero/Larry LaBounty (718) 272-1917

MOD-STOCK RACEWAY
3478 Latta Rd., Rochester, 14612
Tom Gebhart (716) 392-8208

HO/RC RACEWAYS
110 Anderson Ave., Rochester, 14607
Shawn Downey (716) 442-9527

TOY CARS
67 South Main St., Pearl River
(914) 735-0919

MINIATURE GRAND PRIX
2102 W. Genesee St., Syracuse, 13219
Arthur Mason (315) 468-1463

L.I. 1/4-SCALE RACERS
63 Horton Dr., Hunt Sta., 11746
Joe DePinto (516) 351-5384

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TRACK DIRECTORY

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TMC R/C CARS & RACEWAY
205 North Ave., Webster, 14580
Tom McCoy or Mike Sullivan (716) 872-1598

QUEENS OFF-ROAD RACE TRACK
43-32 Kissena Blvd. 7F, Flushing, 11355
John Lee (718) 539-3589

NORTH CAROLINA

EL TIGRE RACING
1911 F Lejeune Blvd., Jacksonville, 28540
Jim & Rhonda Harris (919) 577-1943

DIXIE R/C HOBBY SHOP
P.O. Box 135, Ramseur, 27316
David Spaugh (919) 824-2770

ISLAND RACING HOBIES INC.
6623 Market St., Wilmington, 28405
Jim Painter (919) 392-3683/(919) 686-0723

R/C HOBBY WORKSHOP & RACEWAY
1358 Church St., Burlington, 27215
Dave Guerin (919) 228-6809

JOE'S HOBBY SHOP & RACEWAY
Rt. 2, Box 682B, Bessemer City, 28016
Joe Setzer (704) 435-2912

ASHEVILLE HOBBY SPEEDWAY
Highway 25, Naples, 28760
Jack Murdock/Jack Shelton (704) 684-9814

TRIANGLE OFF-ROAD RACING CIRCUIT
New Hope Rd. Ext., Raleigh, 27612
Frank Winslow (919) 872-6997

TRIANGLE RACEWAY
Daniel Boone Ice Rink, Hillsborough
Larry Dew (919) 471-8934

SWEET UNION R/C RACEWAY
2307 Hargett Rd., Monroe, 28110
Mike Wooten (704) 283-8941

NORTH DAKOTA

BUFFALO CITY ROAD RUNNERS R/C CLUB
Jamestown, 58476
Randy Lynn (701) 285-3353
Gene Martin (701) 252-3941

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115 W. 2nd St., Williston, 58801
Jim Basaraba (701) 572-9313

NORTHERN MINI-RACERS
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Roger Lee (701) 838-0654 or 839-5294

KOUNTRY KILN HOBBY
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Stan Witteman (701) 756-6307

TCRC
Bismark
Bruce Herman (701) 258-3802

VALLEY HOBBIES
Fargo
Bill Neuhauser (701) 235-1272

OHIO

JOHN'S HOBBY SHOP & INDOOR OVAL ASPHALT TRACK
120 South 6th St., Zanesville, 43701
(614) 455-3025

ALCRAFT'S R/C RACEWAY
1370 Custer-Orangeville Rd.
P.O. Box 297, Brookfield, 44403
Larry Jennings (216) 448-1573

NORCAR
3614 Beyerle Rd., Cleveland, 44105

C.O.R.C.A.R.
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John White

NORCAR
848 Wilder Ave., Elyria, 44035
Chuck Mackin (216) 365-6562

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906 Eton Rd., Toledo, 43615
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TOLEDO AREA R/C AUTO RACING
Toledo
Brent M. Gottfried (419) 666-9585

F.F.A. SPEEDWAY
Wayne County Fairgrounds, Wooster 44676
(216) 264-1848

OKLAHOMA

R/C AUTO RACING OF TULSA
Dave Cole (918) 745-9898

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CAR ACTION EAST-WEST OVAL SHOOTOUT

RC Thunderdrome Amateur Entry Form

September 1,2,3 (Labor Day weekend)
Entry Fees: $40, Modified Classes
$40, Stock Class with handout motor

Amateur entries limited to 200
(only one entry per person)
Entry deadline: August 15, 1989

- *Direct-drive Stock (ASA bodies) 6-cell, handout motors, 4 minutes*
- *Direct-drive Modified (Winston Cup bodies) 7-cell, modified motors, 4 minutes*
- *Gear-case Modified (Outlaw or wedge bodies) 7-cell, modified motors, 4 minutes*
- *Road Wizard (Stock Wizard bodies) 6-cell, modified motors, 4 minutes*

(NARA Sanctioned)

Name _____

Address _____

Phone _____ Freq. 1. _____ 2. _____ 3. _____

Make checks payable to: **RC Thunderdrome**

Mail checks and entry forms to: **McAllister Racing, 2205 First Street #107, Simi Valley, CA 93065**

Any R/C car industry manufacturers interested in participating in the Pro Class with racers or sponsorship, please contact Gary at McAllister Racing.

Watch for the Whippoorwill entry form in the next issue of Car Action

TRACK DIRECTORY

(Continued from page 186)

OREGON

YAMHILL COUNTRY R/C CAR CLUB
Yamhill County Fairgrounds, McMinnville
President Garry Elwell (503) 538-9596

R/C SPEED CENTER
2810 N. Pacific Hwy., Medford, 97501
Gene Skelton (503) 779-8298

RADIO CONTROL CAR CLUB
P.O. Box 7053, Beaverton, 97007
Ron (503) 649-7862 or Steve (503) 254-5219

WHEELING RADIO ELECTRIC CAR KLUB
Rt. 4, Box 117A-12 Milton Freewater, 97862
Don Rudy, Secretary

HILL HOPPERS HOBBY SHOP & INDOOR TRACK
2327 10th St., Baker, 97814
Bob Weber/Tom Lager (503) 523-6081

PENNSYLVANIA

BUCK R/C SPEEDWAY
946 Buck Rd., Quarryville 17566
Tim Evans (717) 786-1850

CRESSONA MALL SPEEDWAY
Rt. 61, Pottsville, 17901
Elmer Kramer (717) 622-9728

SUSQUEHANNA R/C AUTO RACING
Susquehanna Valley Mall
Dave Bailey (717) 374-4053

RACE-WAY HEAVEN HOBBY SHOP AND RACING CENTER
2007 S. Juniper St., Philadelphia, 19148
Neal Evers (215) 271-5600

PHILLY R/C RACERS
7790 Dungan Rd., Philadelphia, 19111
Bernie (215) 831-1835

COUNTRY SIDE R/C RACEWAY
1057 Waterman Rd., Clairton, 15025
Fred (412) 653-3529

COCHRANTON AREA RACE CLUB
120 W. Adams St., Cochranton, 16314
Harry Turner (814) 425-7788

Tune in next month for more Track Directory!

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